Qume

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Manual

SPRINT 11 PLUS
Operator

February 1983

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FCC WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed, maintained, and used in accordance with instructions contained in Qume manuals, may cause interference to radio communications. Equipped with a Qume power supply and covers, this equipment has been tested and been found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

Reorder Number 32026

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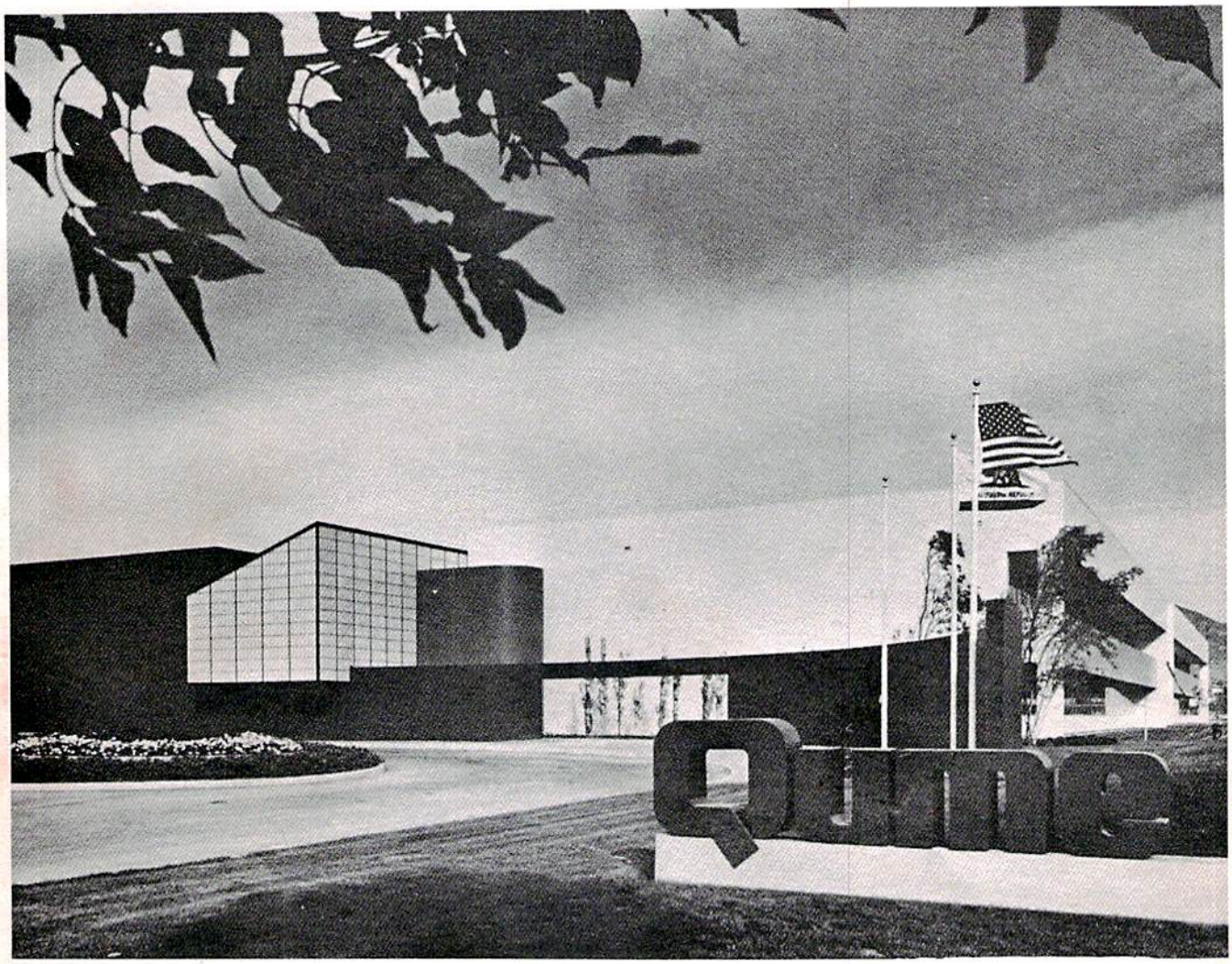

FOREWORD

This manual is one of a group of publications for the SPRINT 11 PLUS. Although all the publications in this group describe the SPRINT 11 PLUS printer, each manual addresses a unique audience. Thus, some subjects appear in several publications, with the text being more or less technically detailed as required for the intended reader.

The following is a list of SPRINT 11 PLUS related publications:

Title	Publication Number
SPRINT 11 PLUS Field Maintenance Manual	32077
Supplies Catalog	38012
Printers and Accessories Catalog	33032

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INTRODUCTION

OVERVIEW

This user manual describes Qume's SPRINT 11 PLUS letter quality printer. The SPRINT 11 PLUS, available with a variety of 96 character "daisy" printwheels, produces letter quality printouts at maximum printspeeds of 40 or 55 characters per second (cps). As the 40 and 55 cps versions of the Sprint 11 perform in nearly identical fashion, the instructions in this manual can be applied to both models.

The SPRINT 11 PLUS is designed for interfacing to a computer system via a QUME CONNECTION interface module. Available in a variety of configurations (e.g., RS-232-C, Centronics, IEEE), the QUME CONNECTION supplies the mechanical connections, electrical circuitry, and program intelligence required for your computer to communicate with the SPRINT 11 PLUS. Refer to your specific QUME CONNECTION Interface Manual for a detailed discussion of the interface module and its command set.

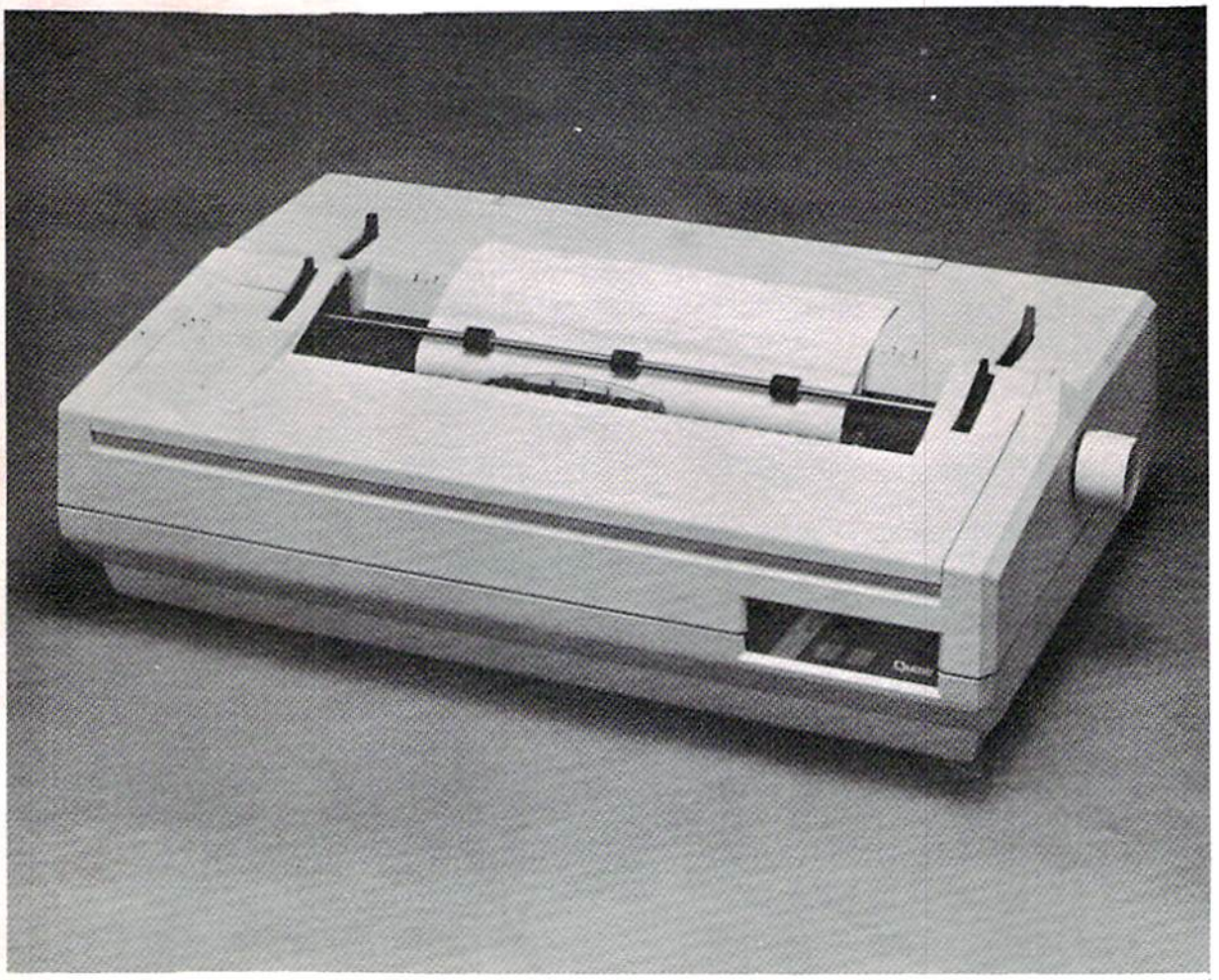

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Figure 1. The SPRINT 11 PLUS Printer

This manual is organized into the following six sections:

The INTRODUCTION section discusses SPRINT 11 PLUS supplies and accessories.

The PRODUCT DESCRIPTION section describes the function of the printer's controls and indicators.

The INSTALLATION AND TESTING section tells how to connect the SPRINT 11 PLUS to your computer and verify that the printer operates properly.

The OPERATING INSTRUCTIONS section discusses daily operating procedures such as loading paper and changing the ribbon and printwheel.

The BASIC MAINTENANCE section provides cleaning and simple troubleshooting suggestions.

The manual's final section, SPECIFICATIONS, provides technical detail about the SPRINT 11 PLUS.

COMPLIANCE WITH SUBPART J Of PART 15 OF FCC RULES

Operation of the SPRINT 11 PLUS printer is within the limits for Class A computing device and complies with the applicable FCC rules as stated on the inside cover.

ACCESSORIES AND SUPPLIES

The following are the available accessories and supplies for the SPRINT 11 PLUS. Accessories and supplies for Qume printers are listed and described in greater detail in the Printers and Accessories Catalog, Reorder No. 33032.

Accessories

Bidirectional Forms Tractor

The Bidirectional Forms Tractor (Qume Part Number 87446-01) accepts and drives continuous forms paper (with standard one-half inch hole spacing). The tractor can adjust to a maximum paper width of 15 inches. Easily installed and removed by an operator, the bidirectional tractor precisely moves paper up or down.

Paper Handling System

Used with continuous forms paper and the Bidirectional Forms Tractor, the Paper Handling System (Qume Part Number 87673) neatly collects the printed forms while ensuring that paper is smoothly fed into the printer.

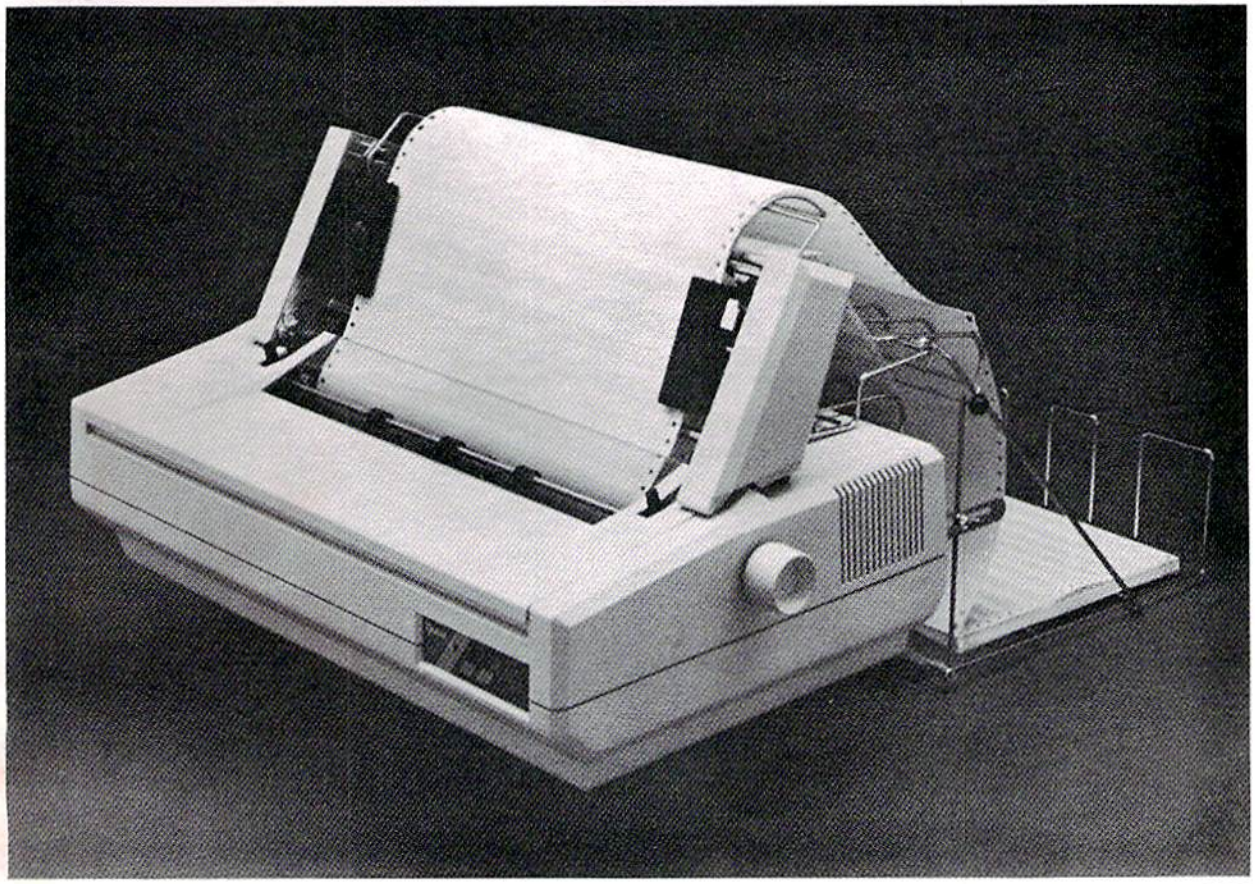

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Figure 2. Bidirectional Forms Tractor and Paper Handling System

SpeedFeed 1 Cut Sheet Feeder

As illustrated in Figure 3, SpeedFeed 1 (Qume Part Number 86760-01) is a platen driven mechanical sheet feeder that is capable of feeding up to 200 cut sheets of 20 pound paper to the printer without operator assistance. SpeedFeed 1 also neatly collects all pages output from the printer. Easily installed and removed by an operator, SpeedFeed 1 accepts paper measuring from 8 to 12 inches wide and from 8 to 14 inches long.

Supplies

Ribbons

Two types of black ribbons are available: Qume Fabric IV continuous loop ribbon (Qume Part Number 84144-01) and Qume Multistrike IV carbon film ribbon (Qume Part Number 83100-01). The continuous loop fabric ribbons provide the best durability, while the carbon ribbons offer the optimum in print quality. Refer to the Qume Supplies Catalog, Reorder No. 38012 for additional information about Qume ribbons.

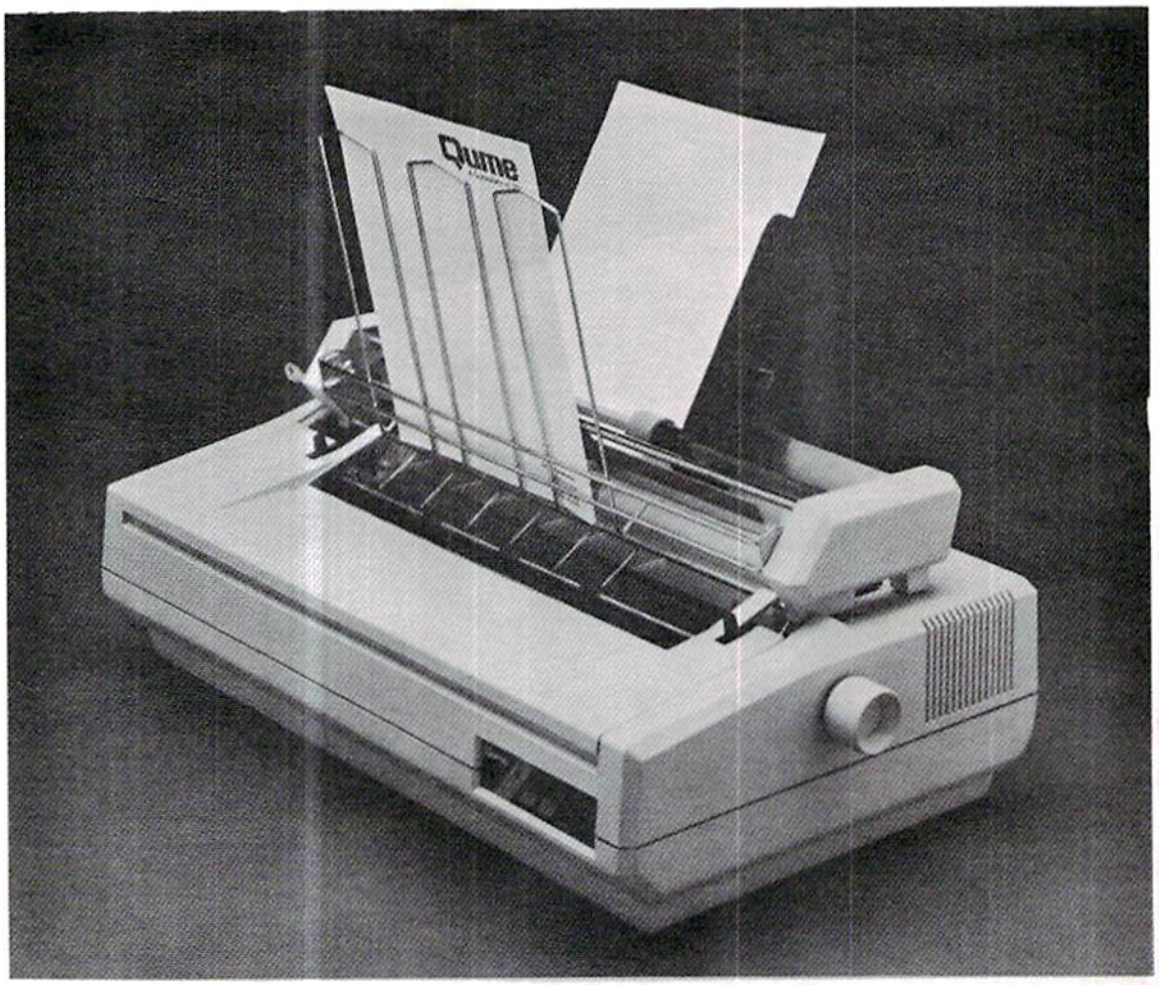

Figure 3. SpeedFeed 1 Cut Sheet Feeder

Printwheels

Over one hundred different Qume printwheels are available in either monospacing (WP) or proportional spacing (WPS) in a variety of type styles. Some of the more popular printwheel styles are listed in Table 1.

Table 1. Selected Qume Printwheels

PRINTWHEEL STYLE	QUME PART NUMBER
WP Courier 10	82050
WP Prestige Elite 12	82052
WP Orator 90% 10	82057
WP Letter Gothic 12	82089
Bilingual Prestige Elite 12	82054
ASCII 96 Prestige Elite	82167
WP Gothic 15	82090
Bilingual Courier 10	82053
WP Pica 10	82051
WPS Essay	82199
WPS Arcadia	82193

WP printwheels are designed to be used with a fixed amount of horizontal spacing (pitch) for each character. The designations 10, 12, or 15 that are appended to the name of each WP printwheel indicate the pitch (number of characters printed per inch). In fixed spacing printing, thin letters such as "i" or "t" are given the same amount of space as the wider characters "W" or "M". Although 10 and 12 pitch printwheels are the most popular, 15 pitch printwheels provide excellent results for specialized applications such as spreadsheet-type accounting programs. With a 15 pitch printwheel, you can print out 132 character-per-line formats in less than nine inches of space.

WPS printwheels are designed such that character width differs from one character to another. These printwheels require variable carriage displacement (horizontal spacing) proportional to the width of the characters. Printing with proportional spacing makes the appearance of the text more aesthetically pleasing since each letter receives the exact space proportional to its width.

The SPRINT 11 PLUS provides a WPS operating mode (DIP switch or software command selectable) that produces automatic proportional spacing when used with a WPS proportional spacing printwheel; your computer does not have to perform any special preprocessing of data. Special sequence printwheels, such as the Deutschland WPS, require that the Twintellect switch be on. Detailed descriptions of all Qume printwheels can be found in Qume Supplies Catalog, Qume publication 38012.

PRODUCT DESCRIPTION

This section identifies basic printer parts.

MECHANICAL CONTROLS

The mechanical controls on the SPRINT 11 PLUS resemble those on a standard office typewriter. Spend a few minutes familiarizing yourself with the operator controls and indicators illustrated in Figure 5.

Operator Access Panel

This panel provides access to the carriage area of the printer, allowing you to change the ribbon and printwheel and to easily perform operator maintenance. A protective interlock switch prevents the printer from printing while the operator access panel is open. To open the operator access panel, slide the panel toward you until it tilts down and hangs parallel to the front control panel as shown in Figure 4.

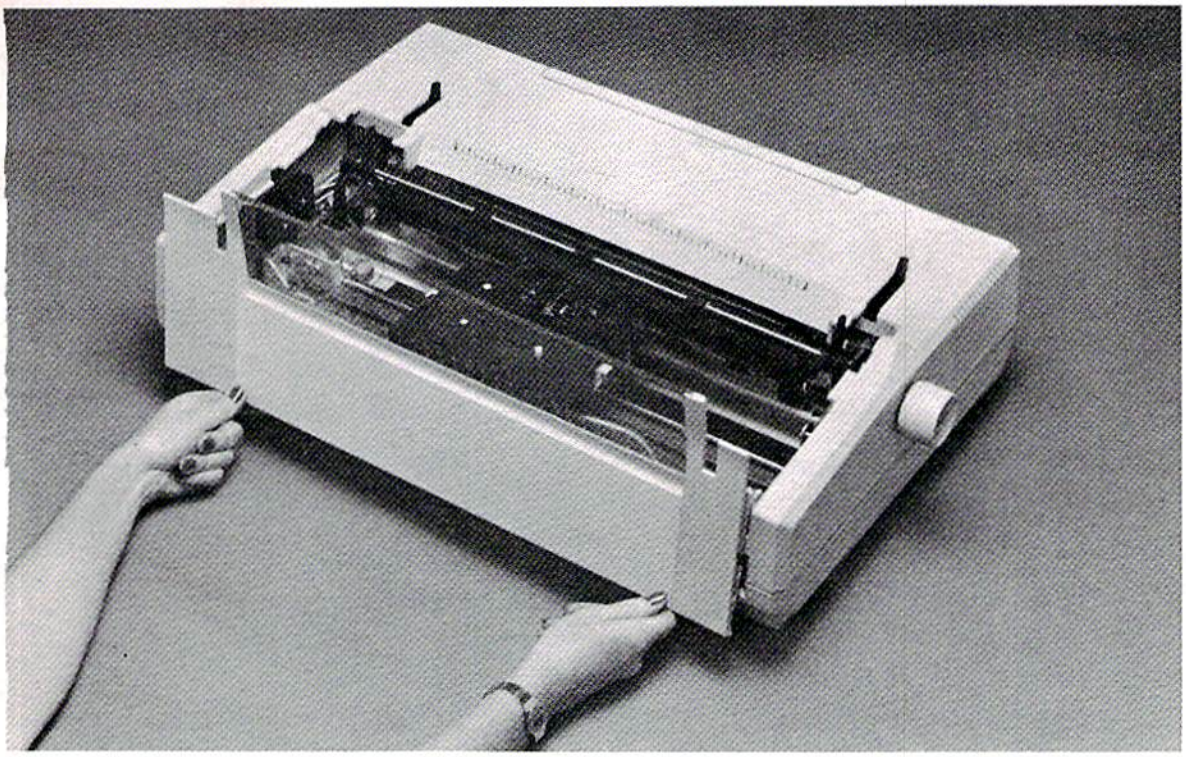

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Figure 4. Removing the Operator Access Cover

Access Cover Inserts

Remove the access cover inserts if Qume's Bidirectional Forms Tractor or SpeedFeed 1 Cut Sheet Feeder is installed on the printer.

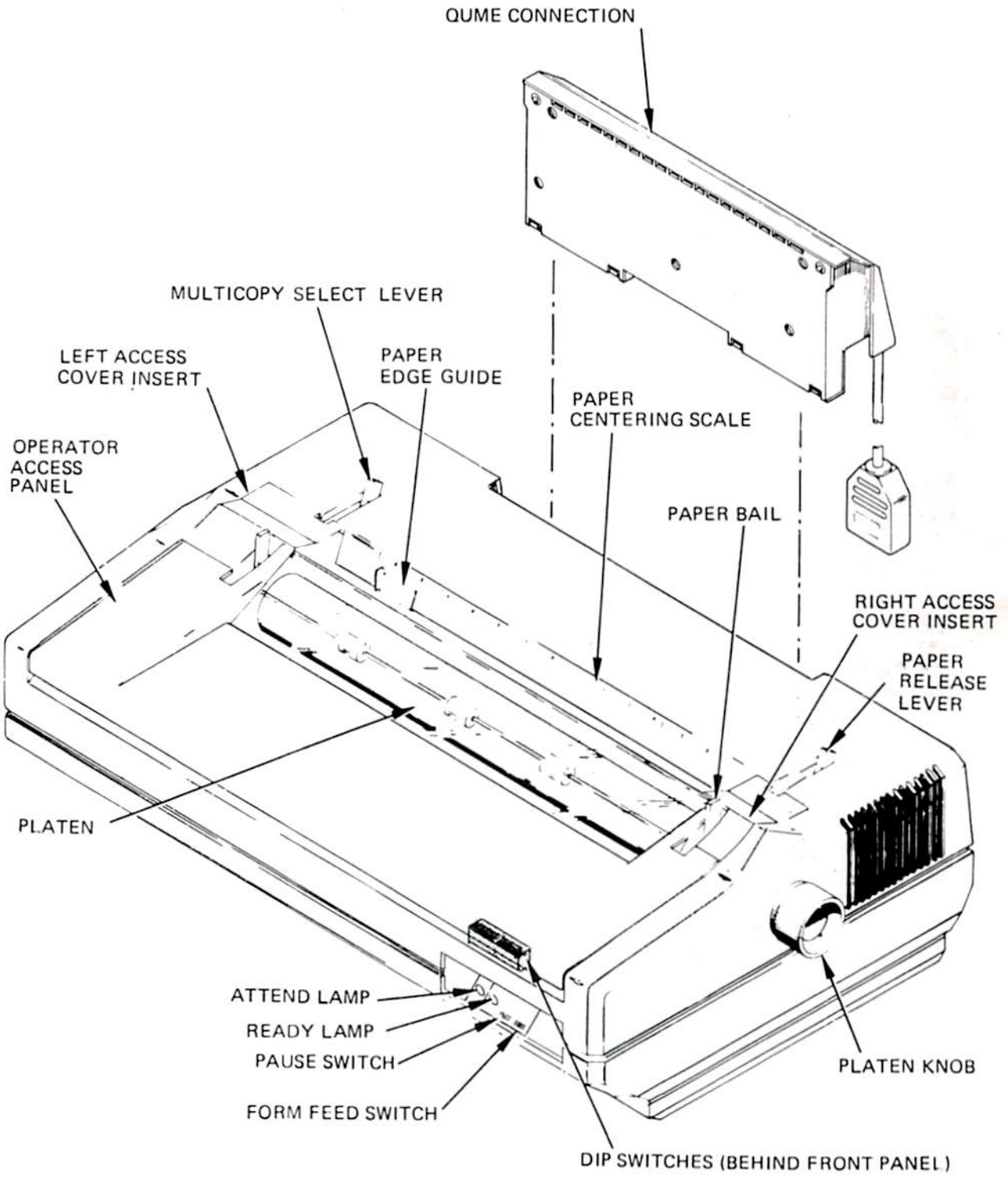

Figure 5. SPRINT 11 PLUS Controls and Indicators

Platen

The platen holds the paper or form in printing position. The cushion face on the platen presents the proper backing for the best print quality and for quiet operation.

Platen Knob

The platen knob moves the paper vertically during loading or unloading.

Multicopy Select Lever

The multicopy select lever adjusts the spacing between the printing mechanism and the platen. Poor print quality will result if this control is placed in the wrong position. For single part forms or ordinary paper, pull the Multicopy Select Lever toward you. For multipart forms or very thick paper, push the lever to the rear. The maximum number of copies that the printer can effectively handle at one time is six, or 0.025 inch total paper thickness.

Paper Bail

The paper bail holds the paper or form against the platen to prevent character smearing and to provide quiet operation. The paper bail is spring loaded against the platen during normal operation. Pull the paper bail forward when inserting paper.

Paper Centering Scale

This scale, similar to scales found on most typewriters, serves as a reference aid when you position paper in the printer.

Paper Release Lever

Pulling the paper release lever toward you (forward) releases the paper by removing the tension between the feed rollers (located below the platen) and the platen. This allows you to adjust the paper or form freely in any direction. The normal operating position of the paper release lever is to the rear. When the Bidirectional Forms Tractor accessory is installed, the paper release lever must always be in the forward position.

Paper Edge Guide

The Paper Edge Guide is a reference guide used to locate the left paper edge at the same place on the platen each time paper is inserted. The Paper Edge Guide may be adjusted to accommodate various paper widths.

Ribbon Out Sensor

The Ribbon Out Sensor, not visible in the illustration, detects when a ribbon cartridge is installed in the printer. The sensor can also detect when a Multistike IV carbon ribbon cartridge is empty. If the ribbon cartridge is empty or if it is removed, the printer will enter the Pause mode, and the front panel indicators will indicate that operator attention is required.

FRONT PANEL INDICATORS AND CONTROLS

Ready Lamp

When illuminated, the Ready lamp indicates that the printer is operational. When the Ready lamp is off and the Attend lamp is on, the printer is in a fault condition called Check and technical assistance is required. The Ready lamp blinks when the printer is in the Pause mode. The printer enters the Pause mode when the PAUSE switch is pressed or when operator attention is required (ribbon out, paper out, cover open).

An audible alarm sounds whenever operator attention is required. It also sounds when a communications error has been detected or when the printer has gone into the Check condition (see ERROR CONDITIONS for details).

Attend Lamp

The Attend lamp is off when the printer is operating normally. It is lit only when operator attention is required or when the printer is in the Check condition. Table 2 summarizes all possible indicator lamp conditions.

Table 2. Front Panel Indicator Lamps

CONDITION	READY LAMP	ATTEND LAMP
Normal printer operation	ON	OFF
Pause switch depressed or operator attention required: ribbon out, paper out, cover off	BLINKS	ON
Pause switch pressed	BLINKS	OFF
Printer in Check	OFF	ON

Procedures for identifying and correcting error conditions indicated by the Ready and Attend lamps are provided under ERROR CONDITIONS.

Form Feed Switch

To obtain a form feed, that is, to vertically advance paper a preset number of inches to the top of the next form, simply press the Form Feed membrane switch when the printer is ON. An audible alarm will sound briefly when the switch is correctly pressed. Form Feed length is determined by the setting of the printer configuration switches located on the back of the front panel.

You may also use the Form Feed switch to initiate the printer's self-test routine. This test produces a continuous swirl or "barber-pole" pattern of all the characters on the printwheel. The test may be used to check individual character printing, print quality, and general printer operation. Refer to the INSTALLATION AND TESTING section of the manual for details.

Pause Switch

This switch is used to stop printing and other printer actions temporarily. Pressing the switch will stop the carriage at the last printed character position. When the Pause switch is pressed a second time, printing will resume with no loss of data. This switch is typically used when ribbons, printwheels, or paper must be replaced. Note that following the correction of an operator error condition (e.g., ribbon out, paper out, cover open), the PAUSE switch must be pressed once before printing can continue. The PAUSE switch is also used to initiate Terminal Self-Test (see RUNNING THE SELF-TEST in your QUME CONNECTION Interface Manual for details).

Configuration Switches

To successfully communicate with the host system, the SPRINT 11 PLUS configuration switches (DIP) must be properly set. Typically, you set the configuration switches when you first connect the SPRINT 11 PLUS to your computer and only change the settings if a different operating mode is selected (e.g., replacing a WP printwheel with a WPS printwheel). The function of all DIP switches on the printer and on the interface is controlled by the QUME CONNECTION interface module. Although the printer DIP switch functions as described below are accurate for the Centronics and RS-232-C versions of the QUME CONNECTION, they do not apply to all QUME CONNECTION modules. Refer to your specific QUME CONNECTION interface manual for a description of printer DIP switch functions.

Two sets of four configuration DIP switches are mounted on the back of the front panel on the SPRINT 11 PLUS printer. An additional set of eight DIP switches is mounted on the rear panel. Figure 6 indicates the function and positioning of each of these switches. Note that in most cases whenever a switch is changed, the printer must be reset before the new setting is honored. Turning the printer power off and on will cause the new setting to be enabled. PITCH, AUTO LF, and 6 or 8 LINES/INCH are the only exceptions to this rule; the printer reads the status of these switches constantly. Remember that the QUME CONNECTION interface module also has a set of configuration switches. Refer to your interface manual to determine the proper positioning of these switches.

TWINTELLECT GERMAN WP

Twintellect electronically sets the printer to accept a special, nonstandard character sequence printwheel. When using standard WP and WPS type printwheels, place the switch in the TWINTELLECT OFF position. The TWINTELLECT position applies to the nonstandard printwheels that the printer is factory programmed to accept (Deutschland WP or Deutschland WPS). If the switch is in the incorrect position, the printer prints inaccurately.

AUTO BIDIRECTIONAL PRINTING
AUTO BIDIRECTIONAL PRINTING OFF

When AUTO BIDIRECTIONAL ON is selected, the printer will print in both directions, thus increasing print speed. Automatic bidirectional printing is totally a function of the SPRINT 11 PLUS; you do not need to preformat data.

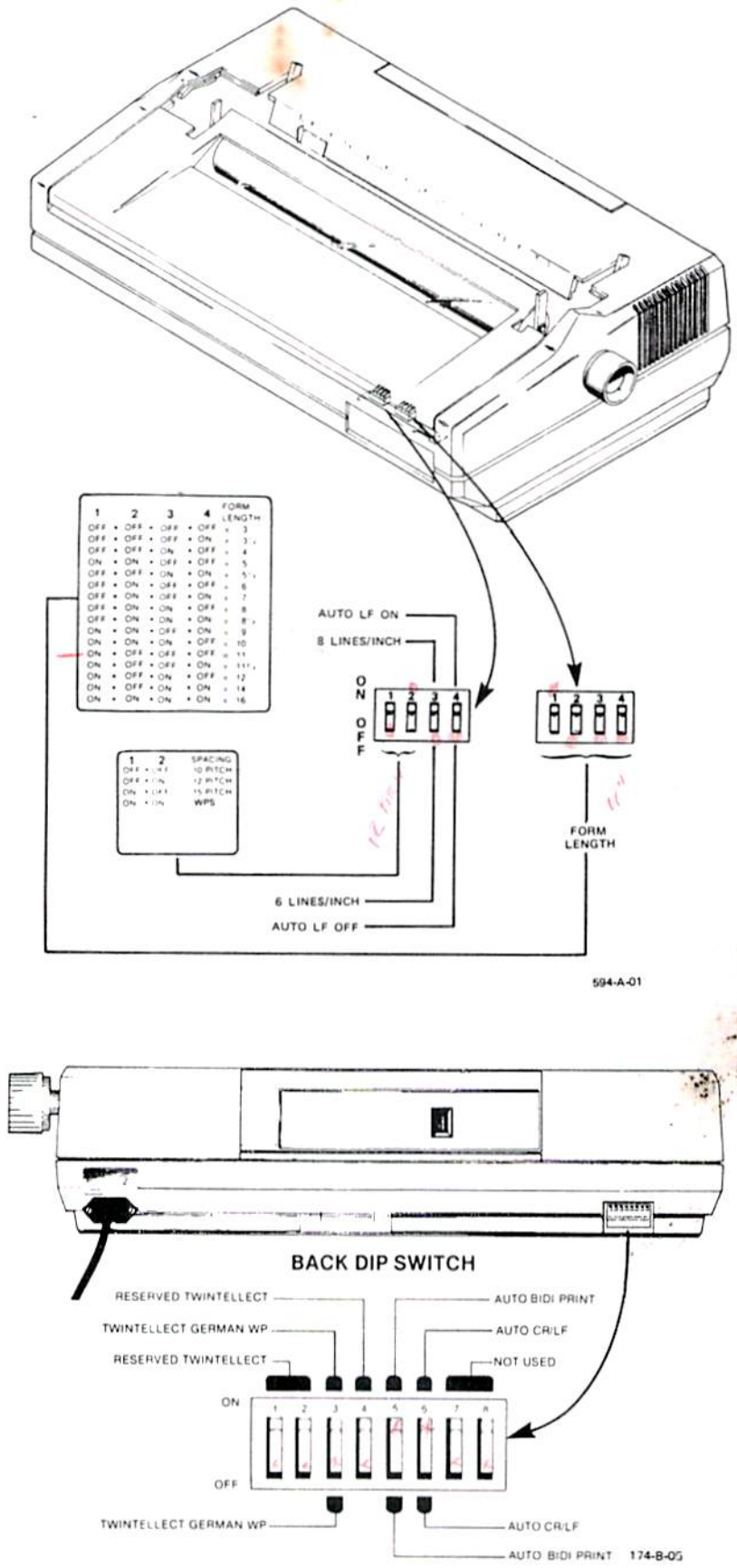

Figure 6. Configuration Switch Functions

AUTO CR/LF
AUTO CR/LF OFF

When AUTO CR/LF is selected, one automatic carriage return and one line feed are generated (regardless of the status of the AUTO LF switch) when the carriage reaches either the right margin or the right end of the platen. When NO AUTO CR/LF is selected, the carriage continues printing past the right margin to the end of the platen. It will remain there until a carriage return and/or a line feed is issued by the computer.

PITCH

These two switches set the printer to print in either one of the fixed pitch modes (WP - 10,12,15) or in the proportional spacing mode (WPS). The wrong combination of printwheel and pitch setting can result in a nonsensical or unattractive printout. To select the desired pitch mode, refer to Figure 6.

FORM LENGTH

These four switches determine the distance of vertical paper motion when the FORM FEED switch is depressed. Sixteen different form lengths are available.

AUTO LF
AUTO LF OFF

When some computers send a line of characters to the printer, they end the line with only a carriage return. Unless a line feed is also issued, the paper will not advance. When AUTO LF is selected, a line feed is automatically generated at each carriage return. This feature saves you the trouble of rewriting your printer software driver to send both a CR and LF at the end of a line. When NO AUTO LF is chosen, a return is generated and the carriage returns to the left margin, but it will remain on the same printing line. A separate LINE FEED command is required if a new printing line is desired.

8 LINES/INCH
6 LINES/INCH

This switch selects six or eight lines per inch vertical spacing. Six lines per inch is the most popular setting.

REAR CONNECTORS AND CONTROLS

Power Cord

One end of this cord plugs into the printer and the other end plugs into an AC receptacle. Be certain that the AC power source satisfies printer power requirements.

AC Line Fuse

This fuse protects the printer's circuitry in case of a power overload or internal failure. Refer to the BASIC MAINTENANCE Section for instructions detailing fuse replacement.

Power Switch

The AC power switch, shown in Figure 7, is located on the back of the printer. This switch turns the printer ON or OFF.

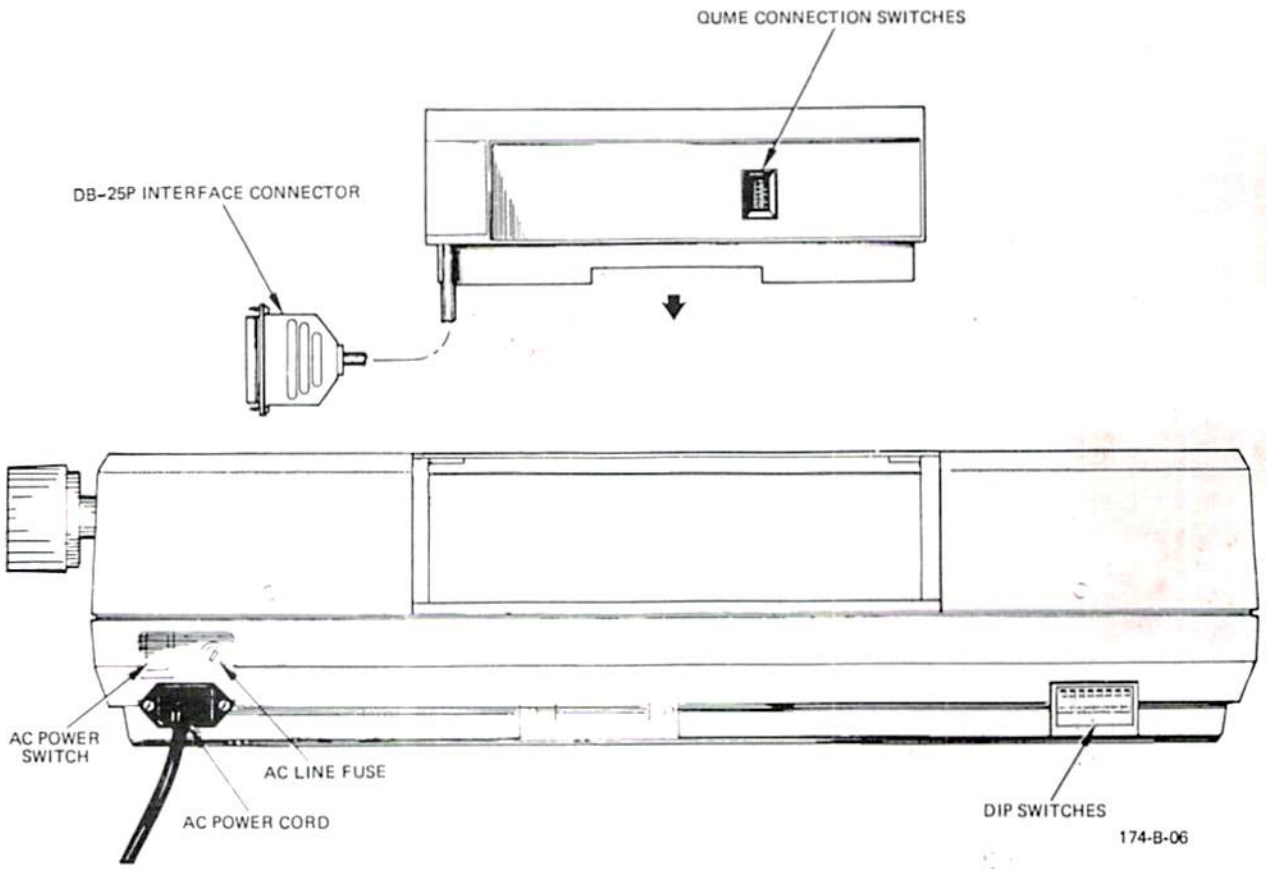

Figure 7. Rear Panel Connectors and Controls

INSTALLATION AND TESTING

To connect the SPRINT 11 PLUS printer to your computer, proceed as follows:

1. Install the appropriate QUME CONNECTION interface module (e.g., Centronics, RS-232-C, IEEE, etc.). The QUME CONNECTION module plugs into the 50-pin edge-board connector mounted on the back of the SPRINT 11 PLUS (see Figure 8).

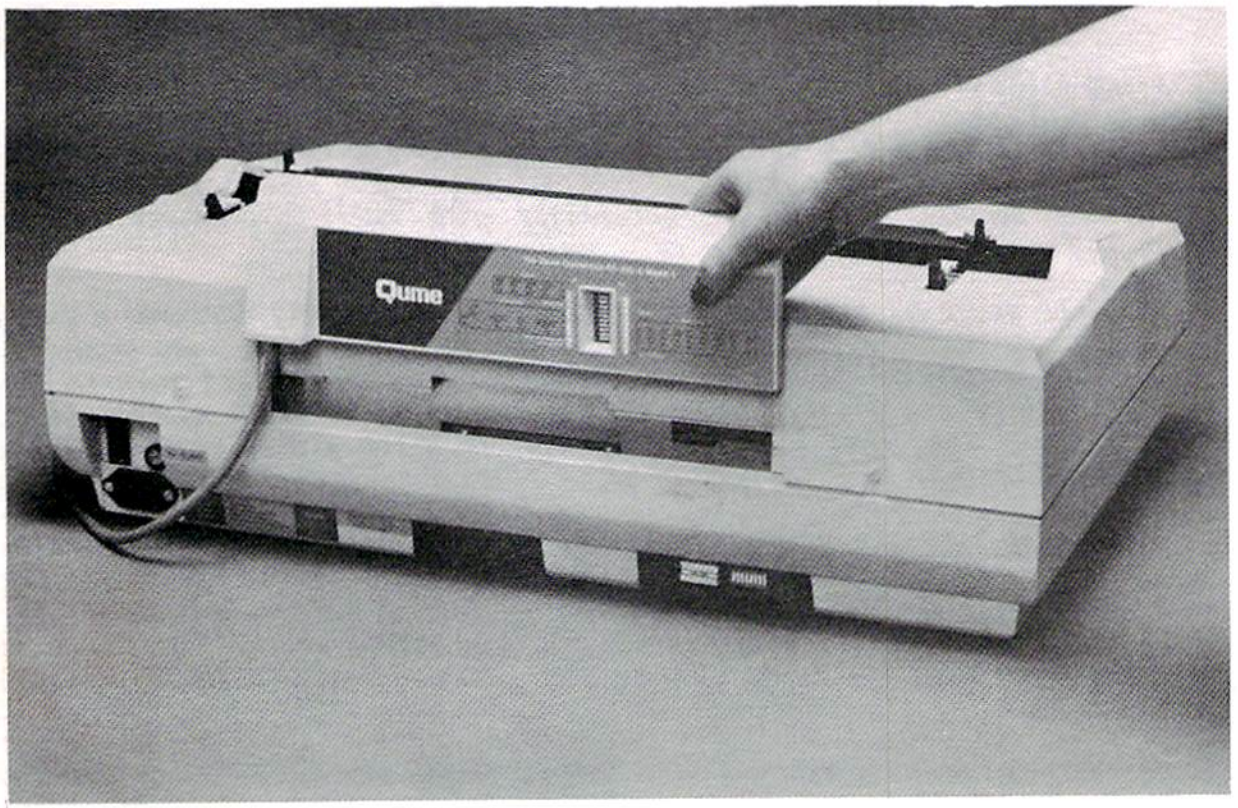

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Figure 8. Installing the QUME CONNECTION Interface Module

2. Connect the interface cable from the QUME CONNECTION interface module to your computer. Note that some computers (e.g., Commodore's PET and CBM units) require an additional cable to successfully mate with Qume's interface module connector. Those of you using the QUME CONNECTION RS-232-C Model 1 Interface module may need to use a sex changer or modem eliminator cable. Refer to your computer reference manual and to the QUME CONNECTION interface manual for details.

3. Set the printer's configuration switches as required for proper operation with your computer. Two sets of four configuration switches are located on the back of the front panel. An additional set of eight DIP switches is located on the rear panel of the printer. Labels describing the functions of these DIP switches are attached to the back of the removable operator access panel (see the Configuration Switches section of this manual for additional details). A third set of configuration switches is

located on the QUME CONNECTION interface module. Refer to the label on the module or to your QUME CONNECTION interface manual to determine the proper positioning of these switches. If either the printer or interface module switches are incorrectly set, the printer will not work properly or may not work at all.

4. Check that the printer's power requirements (refer to the label next to the printer's AC outlet) match the local power source. Plug the power cord into a grounded AC outlet. Failure to use the power cord's ground endangers both you and the printer.

INSPECTION TESTING

After connecting the SPRINT 11 PLUS to your computer (or to a specialized test system), install a printwheel and ribbon cartridge. See the OPERATING INSTRUCTIONS section if you are unfamiliar with these procedures. Then inspect the printer as follows:

1. Turn the power ON and verify that the printer correctly performs a power up restore sequence. During a restore sequence, the Ready lamp should be ON, the printwheel should rotate, and the carriage should move to the left side of the printer (your left when facing the front of the Sprint 11 Plus). Note that the printer's audible alarm always sounds briefly when the printer is first turned on.

2. Load paper into the printer (refer to the OPERATING INFORMATION section for paper loading instructions). If the STOP PRINT ON PAPER OUT configuration switch is on and a paper out detect sensor (available only on the Bidirectional Forms Tractor) is installed, verify that removing the paper causes the Ready lamp to blink, the Attend lamp to illuminate, and the audible alarm to sound.

3. Verify that opening the operator access panel causes the Ready lamp to blink, the Attend lamp to illuminate, and the audible alarm to sound. Verify that removing the ribbon cartridge causes the audible alarm to sound. With the ribbon cartridge removed, replace the operator access panel. Verify that the Ready lamp blinks and the Attend lamp illuminates, indicating an error condition.

4. Push the FORM FEED switch to verify that this results in a paper feed. An audible alarm should sound briefly when the switch is pressed. The amount of paper feed will depend on the FORM LENGTH configuration switch settings.

5. If desired, the printer's basic internal functions may be tested by performing the printer's Self-Test routine. A successful completion of the Self-Test indicates that the electrical and mechanical circuits in the printer are functioning properly. A thorough description of Self-Test is presented in the following section.

6. Exercise the printer by having your computer (or test) system transmit average English text, a listing, or specialized test patterns (See User Test Mode under the COMMAND SET discussion in your interface manual).

7. Verify that all commands have been executed correctly and that all characters have been printed with satisfactory print quality.

RUNNING THE SELF-TEST

The SPRINT 11 PLUS printer includes an internal diagnostic routine (Printer Self-Test) which tests the printer's basic electronic and mechanical functions. This Self-Test can be run even before the SPRINT 11 PLUS is connected to your computer system. A successful completion of Self-Test indicates that all the SPRINT 11 PLUS circuitry is functioning properly. Self-Test can be a valuable aid when you must isolate problems that may have originated from the SPRINT 11 PLUS, the QUME CONNECTION, or your computer system.

Printer Self-Test does not test the circuitry in the QUME CONNECTION interface module. However, many types of QUME CONNECTION interfaces (e.g., RS-232-C, Centronics, IEEE) support a Terminal Self Test, initiated via the PAUSE switch, in which the circuitry of the interface module is also tested. Refer to your QUME CONNECTION interface manual for details.

Before starting the Self-Test, install a good ribbon, a WP printwheel, and paper in the printer. (The paper should be at least 9 and 1/2 inches wide.) Then proceed as follows:

1. Power-down the printer.
2. Firmly press and hold down the Form Feed Switch.
3. Power-up the printer.
4. Release the Form Feed Switch when the printout begins. Figure 9 illustrates a typical printout.

Figure 9. "Barber Pole" Printout from Printer Self-Test

5. To stop a Self-Test, simply power down the printer or depress and hold down the Form Feed Switch until the carriage reaches the end of the current print line.

When Self-Test is first started, the SPRINT 11 PLUS will perform an initialization sequence (the carriage will move to the left and the printwheel may turn). The printer will then begin continuously printing lines of all of the characters on the printwheel in a "barber pole" swirl as illustrated in Figure 9. Note that the barber pole printout will always be in 10 pitch. Also remember that a WP printwheel must be installed to run the printer Self-Test. If a WPS printwheel is in use, the wrong characters will be printed during Self-Test.

OPERATING INSTRUCTIONS

This section provides basic operator instructions for loading paper and installing/changing a printwheel and ribbon cartridge. All of these procedures can be performed easily and quickly if you follow the recommended instructions.

LOADING PAPER

Paper is loaded by hand in much the same way as it is in most office typewriters. The following steps describe standard single sheet paper feed:

1. Pull the paper bail toward you.

2. With the paper release lever to the rear, place the paper behind the platen.

3. Rotate the platen, bringing the paper around the platen and past the paper bail.

4. Pull the paper release lever forward and straighten the paper if necessary.

5. Ensure that the left edge of the paper is inside the paper out detect sensor (if one has been installed on the printer with a bidirectional forms tractor or mechanical sheet feeder). The printer will not work, the READY lamp will blink, and the ATTEND lamp will be illuminated if the paper is not correctly in the paper out sensor and the STOP PRINT ON PAPER OUT configuration switch is ON.

6. Place the paper bail back against the platen.

USING THE CARD GUIDE TO POSITION PAPER

The two top red horizontal lines and the red center vertical line on your printer's card guide can be used to help position paper. To position paper

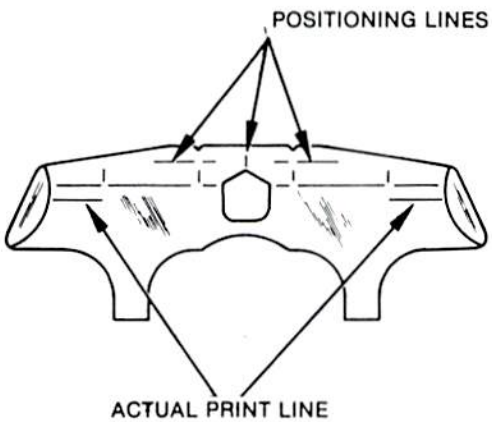

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Figure 10. Using the Card Guide to Position Paper

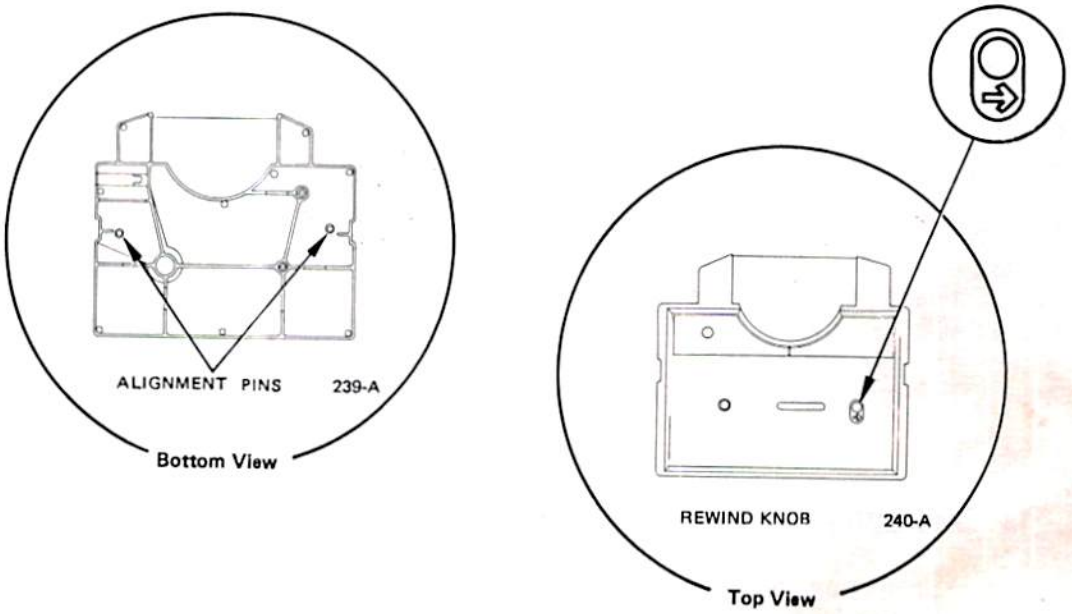
vertically, align the desired print line with the two top positioning lines on the card guide. Then carefully roll the platen downward 12 small "steps." This will automatically set the form at the actual print line. Move the form left to right (pull the paper release lever forward) as required to position it horizontally using the center red positioning line as a reference.

CHANGING A RIBBON CARTRIDGE

To change a ribbon cartridge:

1. Open the operator access panel as described in the PRODUCT DESCRIPTION section.

2. Push down on the ribbon cartridge holding latches and lift up the used



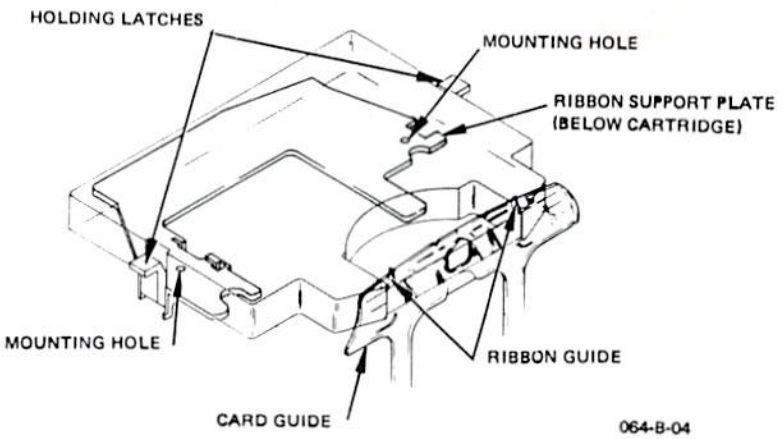


Figure 11. Changing a Ribbon Cartridge

ribbon cartridge. The printer will hold the carriage in place while the ribbon is being changed.

3. To install the new ribbon, take up any slack from the replacement ribbon cartridge by turning the rewind knob on the top of the cartridge in the direction indicated.

4. Place the replacement cartridge onto the ribbon support plate, front first, so that the ribbon will run between the guides and the clear plastic card guide. Then position it securely between the latches and push it down. It will be held down by the latches.

> **NOTE**
>
> Ensure that the alignment pins on the bottom of the ribbon cartridge are inserted into the mounting holes on the ribbon support plate.

5. Make sure the ribbon is taut, not tangled, and is placed in front of the printwheel (between the printwheel and the paper).

6. Close the operator access panel. The Ready lamp will blink, the Attend lamp will be illuminated, and the printer will not print unless the ribbon is correctly installed and the operator access panel is correctly closed. Once all is in order, press the PAUSE switch once to clear the Pause condition and resume normal printer operation.

7. If the ribbon supply runs out during printing, the printer will stop printing and enter the Pause mode. Characters sent from your computer, however, will continue to be received and stored in the printer's buffer. When the buffer is nearly full, the printer will instruct the computer to stop transmitting data. When a new ribbon is installed and the operator access panel is closed, the Attention light will go off but the Ready light will remain blinking. Press the PAUSE switch to clear the Pause condition. Printing then continues with no loss of characters.

CHANGING A PRINTWHEEL

To change a printwheel:

1. Open the operator access panel.

2. Remove the ribbon cartridge (see CHANGING A RIBBON CARTRIDGE procedure).

3. Squeeze the metallic release lever (see Figure 12, Changing a Printwheel) towards the left and gently tilt the printwheel assembly toward you as far as it will go. Do not pull on the hammer assembly.

4. Grasp the rubber printwheel hub firmly and pull upward. The printwheel should slide off. If it does not, wiggle the printwheel hub from side to side while pulling. Never pull on the spokes.

5. Examine the printwheel for ink or dirt buildup and clean if necessary (see the BASIC MAINTENANCE discussion for cleaning instructions). Replace badly worn or damaged printwheels.

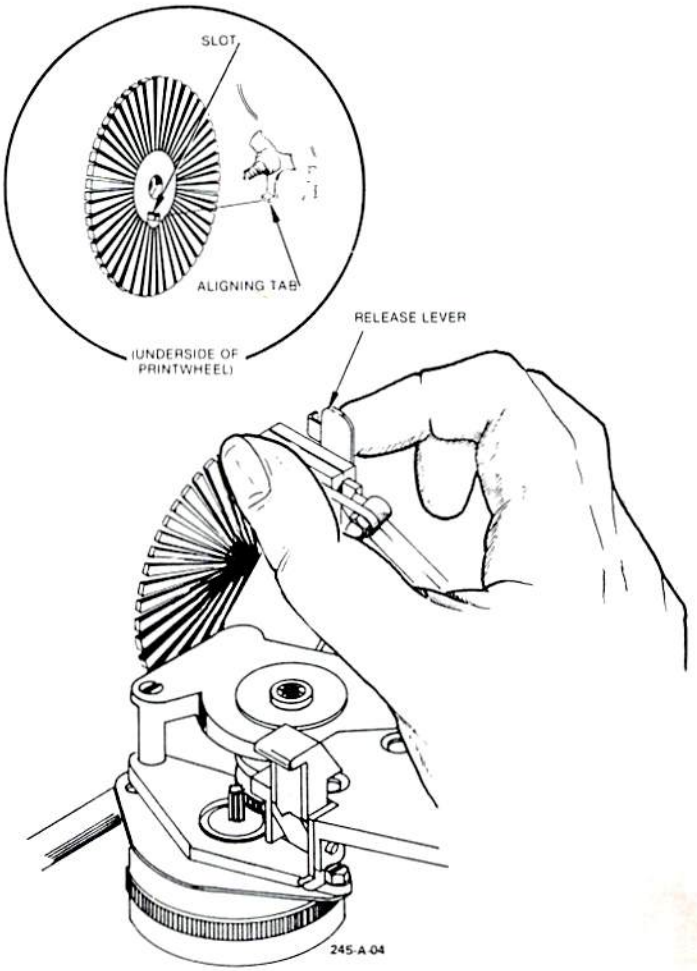


Figure 12. Changing a Printwheel

6. To install a printwheel, position the slot in the printwheel over the aligning tab on the printwheel motor hub. Press down firmly.

NOTE

The SPRINT 11 PLUS can accomodate either fixed pitch printwheels (WP type) or proportional printwheels (WPS type). However, a configuration switch must be set to match the type of printwheel used. Refer to the Configuration Switches section for details.

7. Being careful not to push on the hammer assembly itself, squeeze the release lever and gently tilt the printwheel assembly back into the normal printing position. Ensure that the release lever snaps into place.

8. Replace the ribbon cartridge, and close the operator access panel. The Ready lamp will blink and the Attend lamp will be illuminated unless the ribbon is correctly installed and the operator access panel is correctly closed.

9. Once the Attend lamp turns off, press the PAUSE switch to resume normal printer operation.

BASIC MAINTENANCE

CLEANING PROCEDURES

All printers gradually accumulate paper fibers, ink, and dust. To maintain trouble-free operation and superior print quality, perform the periodic cleaning procedures outlined in this section.

Periodically check and clean the printwheel, the platen, the plastic card guide, and internal surfaces such as the cradle and the bottom pan of the printer.

Always disconnect power from the printer when performing any maintenance procedure.

CAUTION

Never spray cleaners directly into the printer; use only the methods outlined below.

Cleaning the Printwheel

If a fabric ribbon is used, a complete and thorough cleaning of the printwheel may be required periodically. The recommended cleaning solution is a light-bodied, noncaustic cleaner such as Formula 409^{tm} or Fantastik^{tm}. Do not use petroleum base solvents, chlorinated hydrocarbons (Trichlorethylene, etc.), or solutions that leave a powdery residue.

CAUTION

The printwheel cleaning procedure can splatter ink on clothing and surrounding objects. Take the necessary precautions to avoid soiling clothing or other objects.

Open the Operator Access Panel and remove the printwheel (see the section CHANGING A PRINTWHEEL). Clean the printwheel as follows:

1. Place the printwheel in a shallow dish or container.
2. Pour the cleaner into the container until the printwheel is barely covered.
3. Soak the printwheel for a minute or two.
4. Remove any caked-on areas that have not dissolved with a type cleaning brush or a medium stiffness toothbrush.
5. When the printwheel is clean, carefully pat it dry with absorbent cloth or paper towel.

6. Reinstall the printwheel in the printer.

7. Reinstall the Operator Access Panel.

NOTE

Between cleanings, periodically remove the printwheel and brush away loose paper fibers with a moderately soft brush.

Cleaning the Platen

Every few months (or more often, if necessary) remove and clean the platen. The recommended cleaner for the platen is Fedron or an equivalent product. Do not use other solvents such as white gasoline, alcohol, or laquer thinner. These products will clean the platen, but they will also harden the cushion's rubber surface and ultimately ruin the platen.

CAUTION

Fedron will attack paint and plastic parts. Do not use Fedron on any part of the printer except the platen, paper bail rollers, and feed rollers. Before cleaning the platen, remove it from the printer. Fedron is flammable; read and follow all precautions and warnings on the container.

Follow these instructions when removing the platen from the printer:

1. Open the Operator Access Panel.

2. Unsnap and remove the left and right cover inserts.

3. Remove the platen knob by pulling it from the platen shaft.

4. Pull the paper bail forward.

5. Pull the paper release lever forward.

6. Note how the grooved platen sleeve fits into the right printer side frame (see Figure 13).

7. Position your hands as illustrated in Figure 14. With your index fingers, depress the platen release latches just inside both printer side frames.

8. Once the platen is free from the release latches, angle it as shown in Figure 15. Positioned in this fashion, the platen is easily maneuvered to the left and out of the printer. Once removed, the platen should be placed on a flat surface. Take care not to drop it and never stand it on end.

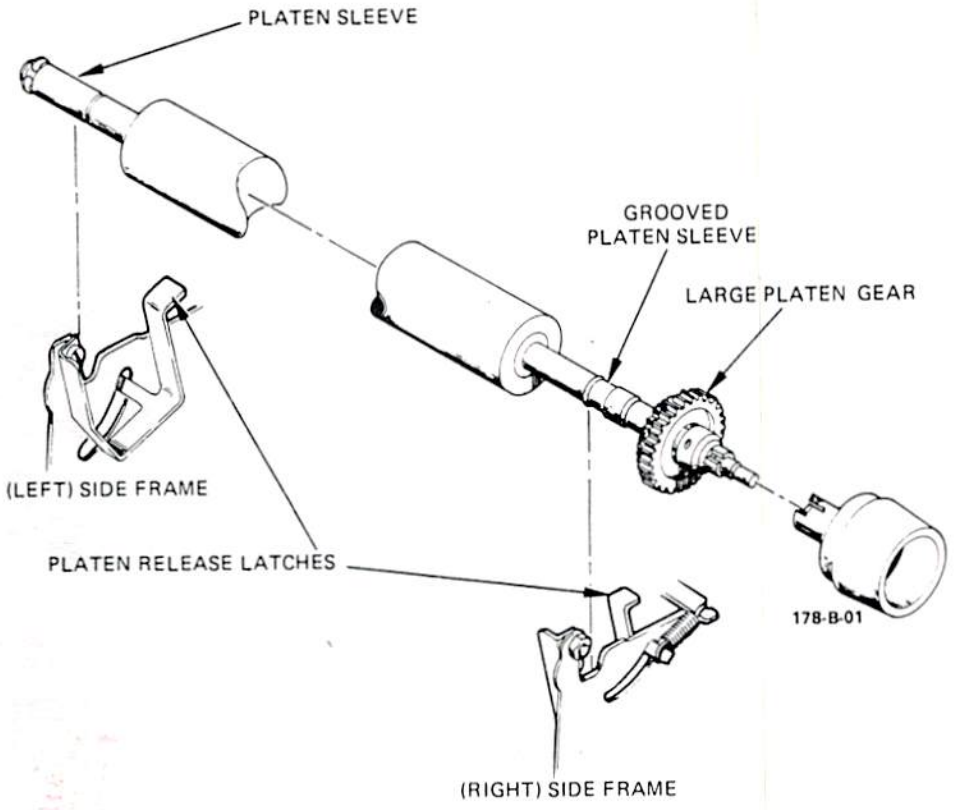


Figure 13. Platen and Side Frame Components

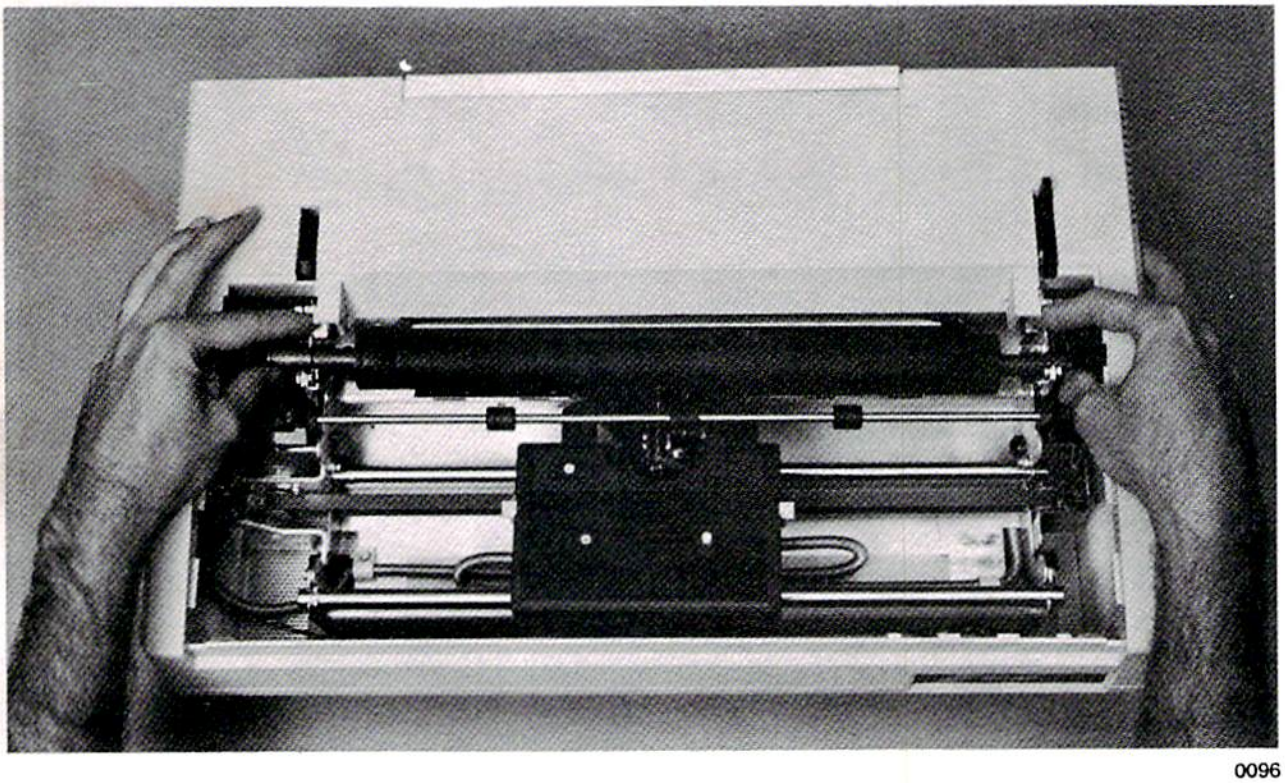


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Figure 14. Releasing the Platen Latches

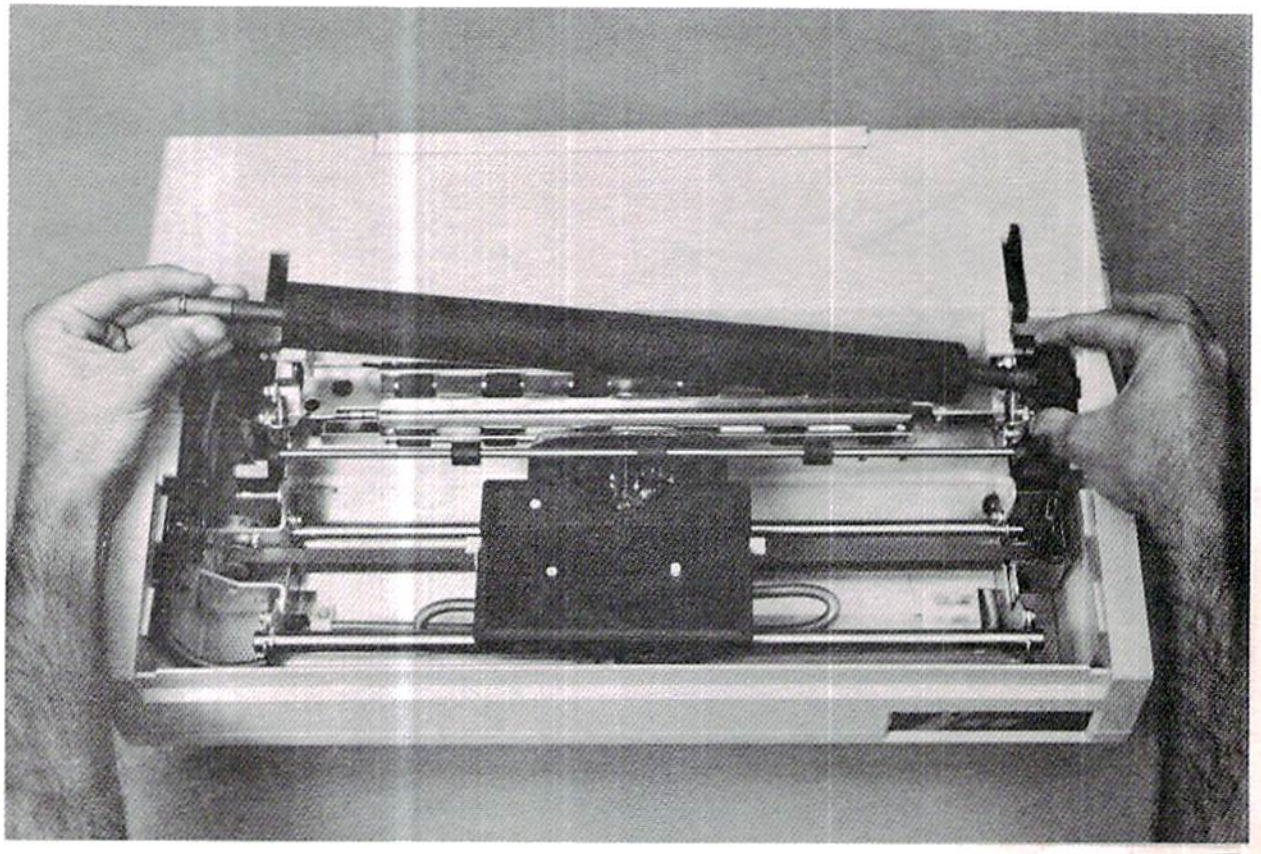

Figure 15. Removing the Platen

Clean the platen as follows:

1. Moisten a soft cloth with Fedron or equivalent.

2. Clean the platen surface and allow to dry. Also clean the feed rollers and the paper bail rollers.

3. Complete the other cleaning procedures (internal surfaces and plastic card guide) outlined in this section before reinstalling the platen.

To reinstall the platen:

1. Gently maneuver the platen into the printer so that the grooved platen sleeve correctly aligns with the right printer side frame.

2. With your index fingers, depress the platen release latches, and push the platen into position with your thumbs. Reinstall the platen knob on the platen shaft.

3. The large platen gear should mesh with the idler gear below and behind it. Rotate the platen knob to ensure that the platen has been installed properly.

4. Set the paper bail back against the platen.

5. Reinstall the Operator Access Panel.

Cleaning the Plastic Card Guide

Ink particles from the ribbon will accumulate on the plastic card guide, obstructing your view of the printed page. While the ribbon, printwheel, and platen are removed, clean the card guide with a soft cloth or tissue using a mild soap; do not use solvents. It is not necessary to remove the card guide for cleaning.

Cleaning Internal Surfaces

While the platen is removed, clean the surrounding surfaces with a mild cleaning solution on a lint-free soft cloth. Do not use solvents; never spray cleaner into the printer.

1. The cradle is the curved metal "tray" that is exposed when the platen is removed. The cradle helps assure smooth passage of paper through the platen. Use a clean, dry cloth or brush to remove paper fibers, dust, or accumulated grime from the cradle. More stubborn grime on the cradle requires the attention of trained service personnel for removal and cleaning. Use Fedron to remove dirt, fibers, dust, and ink from the feed rollers and paper bail rollers.

2. Vacuum the bottom pan of the printer, if required. Remove the AC power cord to the printer if vacuuming.

3. If necessary, any of the metal parts can be cleaned with a safe degreasing solvent such as isopropyl alcohol.

4. Reinstall the platen, printwheel, and ribbon cartridge.

5. Reinstall the Operator Access Panel.

HELPFUL HINTS TO MAINTAIN GOOD PRINT QUALITY

You bought a daisy wheel printer because you were concerned with print quality. The following suggestions, if conscientiously applied, will help you maintain excellent print quality.

1. After receiving your SPRINT 11 PLUS, keep a sample of some early printouts. Use these to help determine when the print quality is deviating from your desired standards.

2. Select the right paper for the job and ensure that the paper is always positioned correctly in the platen.

3. Store your supplies properly. When not in use, printwheels should be stored in their containers and kept out of direct sunlight.

Store ribbon cartridges in a standard office environment. Areas that are too hot, too cold, or too humid can dry out ribbon ink or cause other ribbon damage.

4. Replace worn or damaged printwheels.

5. Perform the basic maintenance procedures listed in this section.

With a well maintained printer, fresh carbon ribbon, and high quality bond paper, the SPRINT 11 PLUS will consistently produce the finest print quality possible.

PRACTICES TO AVOID

Read the following guidelines carefully to help prevent possible damage to the printer or harm to the user:

1. Do not place liquids, paper clips, or other small objects on top of the printer.

2. Do not pull paper against the card guide. Use the paper release lever or FORM FEED switch or manually rotate the platen knob to remove paper from the printer.

3. Do not stand the platen upright on its knob after removing it from the printer. Do not place it where it might roll off and be damaged. A damaged platen causes reduced print quality.

4. Do not place clothing, jewelry, or hands near the printer mechanism while the unit is printing or in the Ready condition.

5. Avoid handling printwheels by the spokes. Printwheels should be handled by the hub only.

6. Do not insert stapled forms into the printer. They may mar the surface, damage the printwheel or platen, or prevent proper paper feeding. Also, do not write on or scratch the platen surface.

7. Do not leave the printer, ribbon, or printwheel in direct sunlight.

8. Never pick the printer up by the platen knob; it is not a handle.

IF YOU HAVE TROUBLE

This operator level troubleshooting guide can help you resolve problems before calling in a service representative. Potential problems are organized into two groups: Printer Problems and Print Quality Problems.

Printer Problems

If the printer should stop printing for no apparent reason, or if it just doesn't work, check for the following conditions:

Does the printer have power? The Ready or Attend lamp should be ON and the fan inside the printer should run when the power switch is turned on. If neither the Ready nor the Attend lamp is lit, check

the AC line cord connection or the AC power switch. Try another electrical appliance in the same receptacle to verify power at the source. Also, check for a possible bad fuse (see Replacing the AC Line Fuse).

Is the operator access panel open? The printer will be disabled when the operator access panel is open or improperly installed. Open and close the operator access panel if there is doubt. The Ready lamp will blink and the Attend lamp will be on if the panel is open.

Is there paper in the printer? Printers equipped with a Bidirectional Forms Tractor or Sheet Feeder and an out of paper sensor are disabled when there is no paper installed and the STOP PRINT ON PAPER OUT switch is ON. Under these conditions, the Ready lamp will blink and the Attend lamp will be ON if paper is not correctly installed.

Is the carbon ribbon cartridge empty? The printer will not print in this condition. Is the ribbon properly installed and located between the printwheel and paper? The Ready lamp will blink and the Attend lamp will be illuminated if the ribbon cartridge is not correctly installed or is empty.

If the printer has power, paper and ribbon are installed, the operator access panel is correctly installed, but the Ready lamp is off and the Attend lamp is on, the printer may have detected an internal fault. Watch the carriage and printwheel through the operator access panel window when you first turn on the printer power. A correctly operating printer performs an initialization sequence when power is applied. The carriage should move to the left side of the printer frame and the printwheel may rotate once. If the printer does not respond when you turn on the power and the Ready lamp is off and the Attend lamp is ON, there is an internal problem in the printer.

Is the printwheel firmly in place? With the printer turned OFF, manually rotate the printwheel and check for interference.

Make sure all cables are properly attached and have not been damaged.

Turn the printer OFF, remove the AC power cord, and look for any foreign matter (paper clips, staples, etc.) inside the printer which might interfere with the operation of the printer. Slide the carriage back and forth and check for freedom of motion.

Perform a Self-Test. A satisfactory completion of this test indicates that the problem may exist outside of the printer (See Running the Self-Test for a detailed description of Self-Test procedures).

If all else fails, call a service representative or return the unit to your dealer. Do not attempt to repair or lubricate the printer; the service representative will do that for you.

Print Quality Problems

1. If the spacing of the characters is very poor, check these things:

   If used, the forms tractor may be improperly installed or adjusted and may be allowing the paper to shift about.

   The printwheel may be worn or warped; try a new one.

   Check the pitch configuration switches located on the back of the front panel. The pitch setting should match that of the printwheel for proper spacing.

2. If the characters are not consistently dark, not sharp, or have spaces and voids in them, check the following:

   The Multicopy Select Lever may be incorrectly set. For single sheet forms place the lever in the forward position (toward you).

   The printwheel may be worn or have broken characters; try a new one.

   The ribbon may be old, dried out, not advancing properly, or scratched; try a new one.

   The platen may be damaged or excessively worn.

3. If the top or bottom part of the characters is missing, check these things:

   The ribbon may be folded over or not correctly installed.

   There may be interference between the ribbon and the card guide.

4. If the ribbon is jamming or not feeding correctly, check these things:

   The ribbon may be improperly installed.

   The ribbon may be winding incorrectly because the rewind knob was turned in the wrong direction. Wind any excess ribbon by turning the rewind knob in the direction indicated on the cartridge. Replace the cartridge if necessary.

5. If the ribbon is breaking or tearing, check these things:

   The ribbon may have jammed. Continued tension may cause the ribbon to break.

   Characters may have cut through the ribbon. This may be caused by an excessively worn platen that is not properly cushioning the paper surface. This may also be caused by improperly setting the Multicopy Select Lever.

6. If the print line is skewed or slanted, check these things:

   Check for an improperly installed or bent paper cradle underneath the platen.

   Check for proper paper loading if using a forms tractor.

   Check that the Paper Release Lever is set to the rear position (pushed away from you) if using the friction platen.

REPLACING THE AC LINE FUSE

Replace the AC line fuse as follows:

1. Turn the printer power off and unplug the AC power cord.
2. Remove the fuse housing on the rear of the printer with a screw driver by turning counterclockwise.
3. The AC line fuse must be replaced with a replacement fuse of the proper rating. All printers configured to run at 115 Vdc require a 5 amp, 3 AG/250 V fuse. Printers that run at 220/240 Vdc require a 3 amp fuse.
4. Install the fuse in the housing and reinstall the housing on the printer.
5. Reconnect the AC power cord and try the printer. If the new fuse blows, there is a problem with the printer. Call for technical assistance.

ERROR CONDITIONS

The Qume SPRINT 11 PLUS printer is designed to notify both you and your computer of certain error conditions. This section discusses the types of faults that can be detected and the manner in which the printer reacts to these conditions.

Ribbon Out

When the ribbon supply is exhausted or the ribbon cartridge is removed, (1) the Ready lamp will blink, (2) the Attend lamp will be illuminated (3) the audible alarm will be sounded, (4) all command execution will be stopped, and (5) the STATUS REPLY command bit 3 will be set. Please note that the ability of the SPRINT 11 PLUS to process a STATUS REQUEST command depends upon the type of QUME CONNECTION installed. See your QUME CONNECTION interface manual for details.

Paper Out

If the optional paper out detect sensor is installed on the Bidirectional Forms Tractor or Sheet Feeder and the STOP PRINT ON PAPER OUT configuration switch is ON, running out of paper will (1) blink the READY lamp, (2) illuminate the Attend lamp, (3) sound the audible alarm, (4) stop all command execution, and (5) set bit 3 in the STATUS REPLY.

Cover Open

When the operator access cover is opened, or the top cover is removed, (1) the Ready lamp will blink, (2) the Attend lamp will be illuminated, (3) the audible alarm will be sounded, (4) all command execution will be stopped, and (5) bit 3 of the STATUS REPLY will be set.

Check Condition

When the printer detects an internal fault condition, it enters a protective mode which disables the carriage, printwheel, and hammer circuits. This error condition, called Check, is a safety measure designed to prevent internal electronic or electromechanical damage.

There are several reliable methods by which you can identify a Check condition. First look at the printer's front panel indicators. The Ready lamp will be off, the Attend lamp will be on, and the audible alarm will sound momentarily when the printer goes into Check. A Check condition can also be identified by what appears to be a total loss of power to the electro-mechanical assemblies. If the printer's fan is running and you can freely slide the carriage back and forth, the printer is in Check.

The printer is not in Check when the operator access panel is open, the ribbon cartridge has been removed, or the optional paper out sensor detects paper out. Under such conditions the printer is in the PAUSE mode. The Ready light will be blinking and you will be unable to move the carriage with your hand. Replacing the cover and/or the ribbon cartridge and paper returns the printer to normal operation as soon as the PAUSE switch is pressed.

When the printer goes into Check, commands that have been temporarily stored in the printer's receive buffer are lost; all subsequent commands will be ignored except the INITIALIZE PRINTER and STATUS REQUEST (not supported by all Qume Connection interface modules) commands. Note that when the RS-232-C version of the QUME CONNECTION is installed, the SPRINT 11 PLUS sends the host system a 250 ms break and sets bit 4 in the STATUS REPLY whenever a Check condition occurs (see the QUME CONNECTION RS-232-C manual for details.

If you discover that your printer is indeed in Check, try to restore it to its normal operating condition by (1) turning the printer OFF and back ON or (2) by sending the INITIALIZE PRINTER command (ESC SUB I or ESC CR P) from your computer. If this fails to clear the Check condition, refer the problem to your service representative.

A NOTE ABOUT STATIC ELECTRICITY

The printer can withstand static electricity discharges that are normally found in the typical printer environment. Static electricity is generally not a problem in most areas and can usually be ignored. However, some of the new man-made fibers and materials that are used in clothing, carpets, shoes, etc. in very low humidity environments can cause unusually severe static discharges. Although these discharges are of extremely short duration, they

may measure many thousands of volts, causing momentary pain but no lasting damage to humans.

The printer can also be temporarily upset by particularly severe static discharge. If this happens, the printed output may be scrambled and unpredictable for a character or two, or possibly as much as an entire line. This temporary condition is self-clearing, and the printer will return to proper operation. Other unexplained errors can also be caused by such discharges.

If static discharge becomes a problem, some precautions can be taken to avoid the annoyance. If possible, raise the relative humidity of the environment to above 30%. During extremely dry conditions, avoid moving toward or brushing against the equipment when it is already working. Movement generates static electricity.

Treat the surrounding carpet or floor area with antistatic sprays usually available from carpet dealers or large department stores. These sprays generally require twice a week applications for the first few weeks, and once a month after that. In some cases, an antistatic mat may be desirable. These are available through industrial material suppliers.

SPECIFICATIONS

Print Speed

Print speed varies according to the model of the printer, the sequence of characters being printed, the amount and sequence of carriage and paper motions mixed with character printing, and the proper use of the various capabilities of the printer (high speed electronic tab, bidirectional printing, etc.).

The SPRINT 11 PLUS/40 has a maximum print speed of 40 characters per second. The SPRINT 11 PLUS/55 has a maximum print speed of 55 characters per second.

Print Generation

The SPRINT 11 PLUS printer prints full characters of electric typewriter quality in serial sequence. The print is generated by a ballistic hammer striking the back of an individual character. This impact forces the character face against a hard rubber platen. A carbon ribbon or an inked fabric ribbon between the character face and the platen prints a clear impression of the struck character on paper inserted around the platen.

The ballistic hammer force is microcomputer controlled to one of six intensities according to character size.

Printwheel

The set of 96 printing characters is arranged around a plastic "daisy" printwheel. Printwheels are easily operator changeable. Operator selectable fonts are available in 10, 12, and 15 pitch (characters per inch) and proportional spacing. A wide variety of standard font styles is available (see Qume Supplies Catalog 38012). Some nonstandard font styles (listed in Catalog 38012) may only be used when the Twintellect configuration switch is set or when special Twintellect tables have been downloaded to the printer (see the QUME CONNECTION Interface manual for details).

Ribbon

Operator replaceable plastic cartridge with black Multistrike IV carbon film or endless loop Fabric IV ribbon. End of ribbon detection standard. Ribbon advance is automatically proportional to the width of the printed characters.

Paper Feed/Platen

Friction platen, gear driven. The standard friction feed mechanism can accept one original and three copy sheets up to a total thickness of 0.025 inches.

Forms

Single sheets or continuous forms, with or without sprocket holes, may be used.

Maximum useable paper width is 15 inches (38.1 cm).

Sixteen operator selectable form length settings.

Format

Vertical and horizontal locations of each character are fully programmable within the following defined parameters:

HORIZONTAL

Bidirectional carriage motion in increments of 1/120 inch. Mode Switches select 10, 12, or 15 character per inch or WPS sequence proportional spacing.

132 columns at 10 characters per inch (cpi)
158 columns at 12 cpi
198 columns at 15 cpi
120 positions per inch

Slew rate of 21 inches/second (SPRINT 11 PLUS/40)
Slew rate of 30 inches/second (SPRINT 11 PLUS/55)

Electronic tabbing and carriage return of 13.1 inches maximum at 650 ms maximum (SPRINT 11 PLUS/40) and 450 ms maximum (SPRINT 11 PLUS/55).

Bidirectional carriage motions from 1/120 inch to 94/120 inch can be commanded by the host system.

VERTICAL

Operator selectable 6 or 8 lines per inch.

Slew rate of 2 inches per second (SPRINT 11 PLUS/40).
Slew rate of 3.5 inches per second (SPRINT 11 PLUS/55).

48 positions per inch, up or down, by external program commands, from 1/48 inch to 59/48 inch.

Plotting

Programmable graphics mode with resolution of up to 5760 points per square inch (1/120 inch horizontally; 1/48 inch vertically). Resolution of 17,280 points per square inch using the three periods (two offset vertically by 1/144 and 2/144 inch respectively) on Qume's Letter Gothic WPLOT printwheel (Qume Part Number 82189, available on special order).

Operator Controls

Paper Release lever, Multicopy Select lever, and an operator accessible ON/OFF AC power switch.

Front Panel: Form Feed switch, Pause switch, Ready lamp, and Attend lamp standard.

Communications Interface

Accomodates a wide variety of plug-in QUME CONNECTION interface modules.

Electrical

AC POWER REQUIREMENTS

Power supply selectable for 115 (95-132) or 230 (190-264) Vac, 49-63 Hz single phase, 150 watts.

Physical Dimensions And Weight

Height: 6.63" (16.84 cm)
Width: 23.22" (59.98 cm)
Depth: 14.34" (37.69 cm)
Weight: 37 lbs (16.65 kg)

Environment

TEMPERATURE

Operating: 50°F to 104°F (+10°C to +40°C)
Storage: -40°F to 169°F (-40°C to +60°C)
(Storage temperature specifications assume printer is stored in Qume shipping container)

HUMIDITY

Operating: 10% to 90% relative, noncondensing
Storage: 10% to 95% relative, noncondensing (when stored in Qume shipping container)

Vibration

Operating: 10 to 60 Hz, 0.5 g maximum
Storage: 10 to 300 Hz, 2.0 g maximum in shipping container

Noise Generation

63 dBA maximum (Sprint 11/40 Plus)
65 dBA maximum (Sprint 11/50 Plus)

Regulatory Agency Approvals

The Qume SPRINT 11 PLUS is designed to meet or equal the following agency specifications for EMI/RFI and safety:

FCC Rules & Regulations for Class A computing devices
UL 478;
CSA C22.2 No. 154;
VDE 0871-6/78, Level B;
IEC 380 (Comparable to ECMA 57 and VDE 0804/0805)

Reliability/Serviceability

MTBF at 25% duty cycle - 5,000 hours
MTTR 30 minutes

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Please restrict your comments to the usability, accuracy, readability, organization, and completeness of this document.

1. Please specify by page any errors you found in this manual.

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2. Does the document cover the information you expected or required? Please make suggestions for improvement.

_____

_____

_____

3. Is this the right type of document for your needs? Is it at the right level? What other types of documents are needed?

_____

_____

_____

4. Did you have any difficulty understanding descriptions or wording? Where?

_____

_____

_____

5. Please rate this document on a scale of 1 to 10 with 10 being the best rating _____

6. Dealer/Distributor where product purchased: _____

_____

_____

NAME _____ DATE _____
TITLE _____
COMPANY NAME/DEPARTMENT _____
ADDRESS _____
_____ STATE _____ ZIP CODE _____

Please check here if you require a written reply. ☐

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Bidirectional Forms Tractor User Instructions

INTRODUCTION

The Bidirectional Forms Tractor (QPN 87446-01) accepts and drives continuous forms with standard one-half inch hole spacing. The tractor can be adjusted to paper that is from 2 to 15.75 inches wide. Unlike ordinary "one-way" or unidirectional tractors, the bidirectional tractor can move paper effectively up or down. Note there are two sets of gates on the tractor, one on the front and one on the back. In addition, the tractor has a Dynamic Tension Control feature (patent pending) for proper adjustment of the paper tension around the platen.

The Qume Bidirectional Tractor fits all standard 132 column Qume printers and terminals. Although the method of installation differs slightly with the variety of carriage area access covers, it remains very simple. Some Qume covers snap into and out of place and some are hinged.

For models with covers with removable inserts remove the inserts as shown in Figure 1 below. For models with covers which have sliding inserts, move the inserts forward (toward the operator) to allow access to platen.

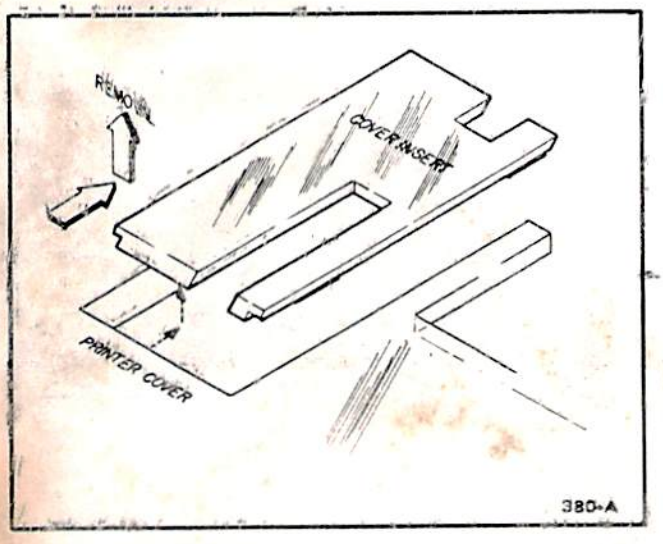

Figure 1. Removal and Installation of Carriage Area Cover Inserts

PREPARING THE PRINTER FOR FORMS TRACTOR INSTALLATION

For models with hinged access covers, modify the printer or terminal cover as follows. You will need a medium size screwdriver.

1. Open the top cover.

2. Loosen (BUT DO NOT REMOVE) both the left and right top cover hinge screws as shown below.

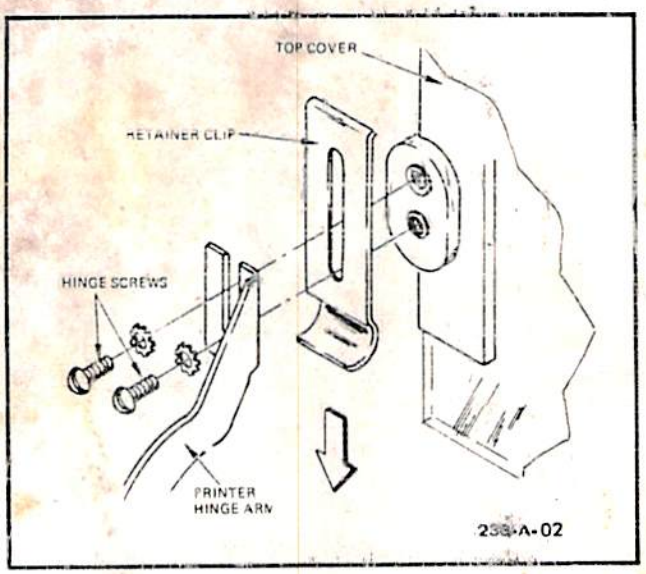

Figure 2. Cover-Hinge Assembly

3. Slide the top cover up and off its hinges.

4. Push down on the hinge arms to get them out of the way.

5. On the top cover, pull out the retainer clips all the way on each side (toward the rear of the terminal) and tighten the hinge screws. Now the cover is removable by sliding it in and out of place.

6. Slide out the removable top cover inserts. Store these inserts temporarily in an envelope so they will not get lost; you may wish to replace them at another time.

INSTALLATION OF BIDIRECTIONAL FORMS TRACTOR (All 132 column models of printers and terminals)

The Qume Bidirectional Forms Tractor is held in place by two self-activating clamps and is easily installed and removed without the cumbersome use of release latches. The opening and closing of the clamps are controlled by the position in which the tractor is held. Tilting the tractor forward opens the clamps and tilting the tractor backwards closes them. The tractor clamps are held closed and tightened around the platen sleeve by the lever action of the tractor resting on the top of the cover.

1. Remove the carriage area access cover from the printer.

2. Pull the paper bail forward.

3. Hold the tractor above the printer and tilt the unit slightly forward so that the clamps are in the "open" position. Refer to Figure 3.

4. Position the tractor clamps into the printer so that the right clamp fits into the groove between the spacer and the small gear on the platen sleeve. Tilt tractor back so its feet rest on the printer cover.

5. When correctly in place, the forms tractor gear should mesh with the small platen gear. Turning the platen will drive the forms tractor.

6. Adjust the two rear support screws on the forms tractor so that the bottom of the tractor is parallel to the printer top, as shown below.

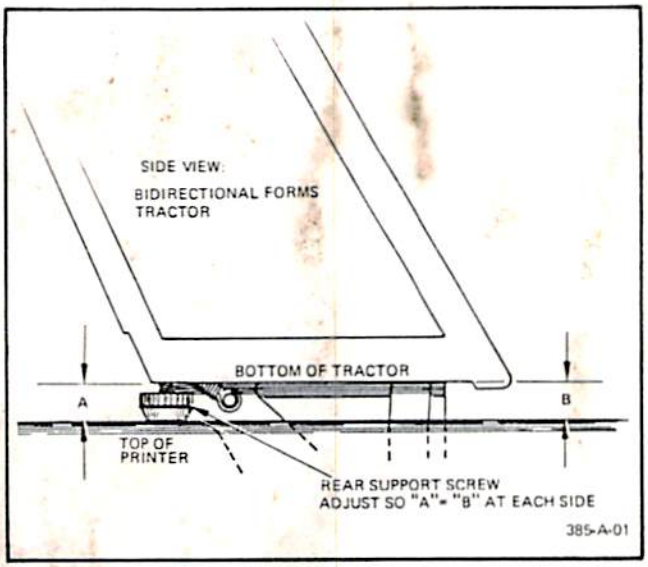

Figure 4. Rear Support Screw Adjustment

7. Make sure the tractor clamps hold securely onto the platen. Check this by pulling the forms tractor straight up (not forward). If either of the latches does not hold the tractor to the platen, the rear support screw behind that latch is not properly adjusted. Turn the rear support screw further into the tractor (i.e., the forms tractor support screw appears shorter). Distance "A" in Figure 4 should **not** be more than distance "B".

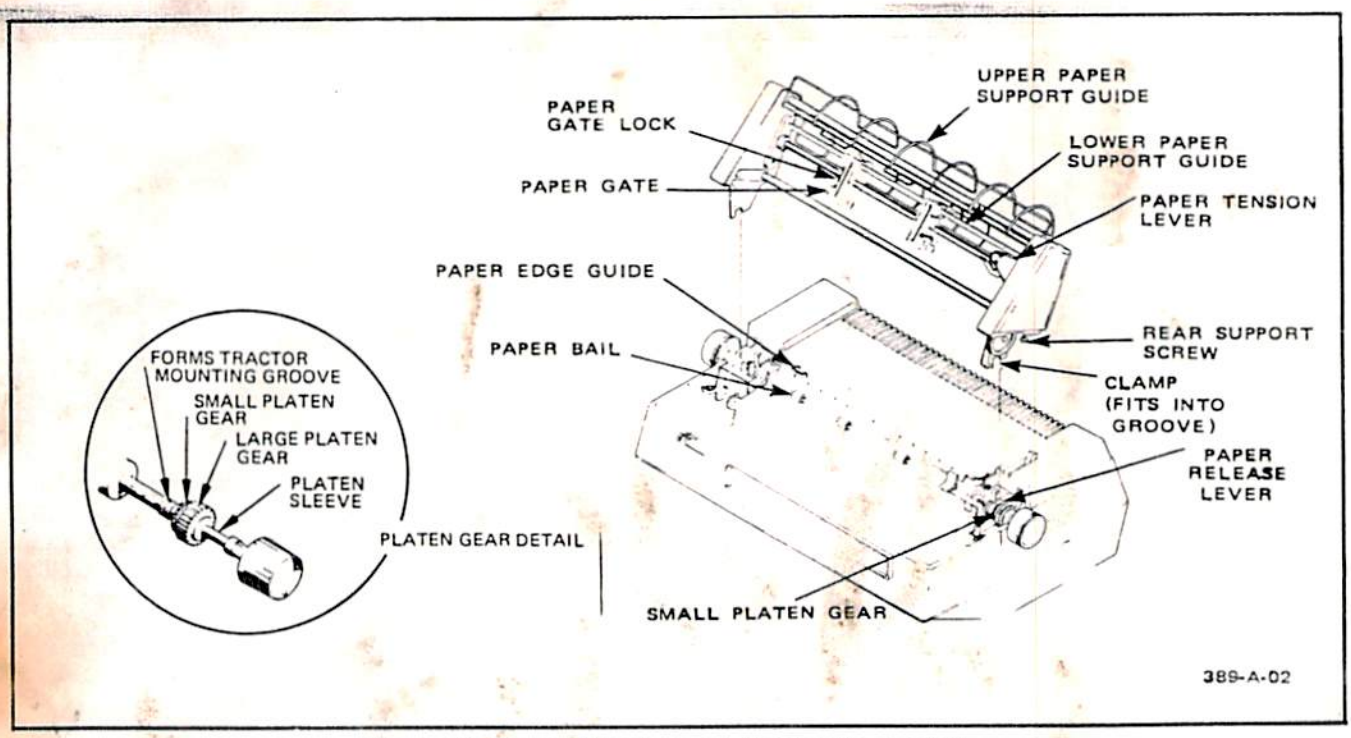

Figure 3. Forms Tractor and Printer Assembly

LOADING PAPER (All models)

1. Before loading paper, make sure the tractor paper tension lever is in the down (slack) position, as shown below.

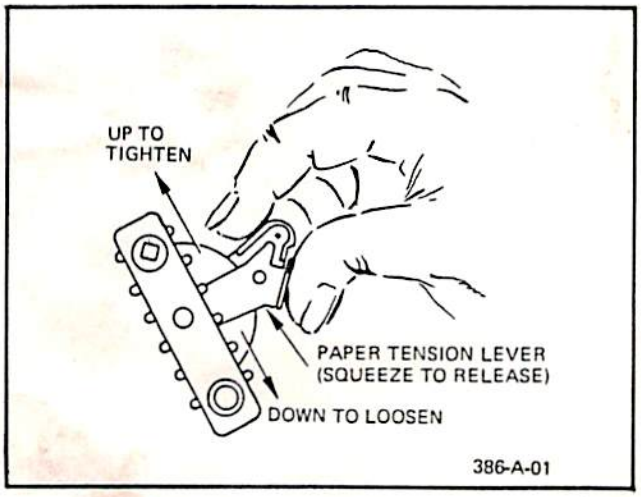

Figure 5. Paper Tension Assembly

2. On the printer, pull the paper bail forward (towards the operator) and set the paper release lever to the rear.

3. Loosen the tractor paper gates by pressing down on the paper gate lock levers. Push the gates to each side. Refer to Figure 6.

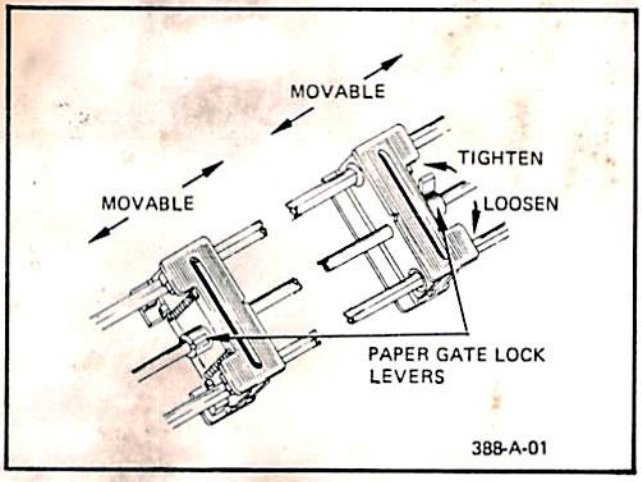

Figure 6. Paper Gate Adjustment

4. Pull upper paper support guide toward the front of the tractor to allow access for easier paper loading.

NOTE

Paper can be loaded with carriage area access cover on printer. Generally, it is easier to remove the cover so that the tractor can be tilted forward. This allows easier access to the rear paper gates.

5. Insert paper over lower paper support guide located in back, above rear paper gates. The path is shown below.

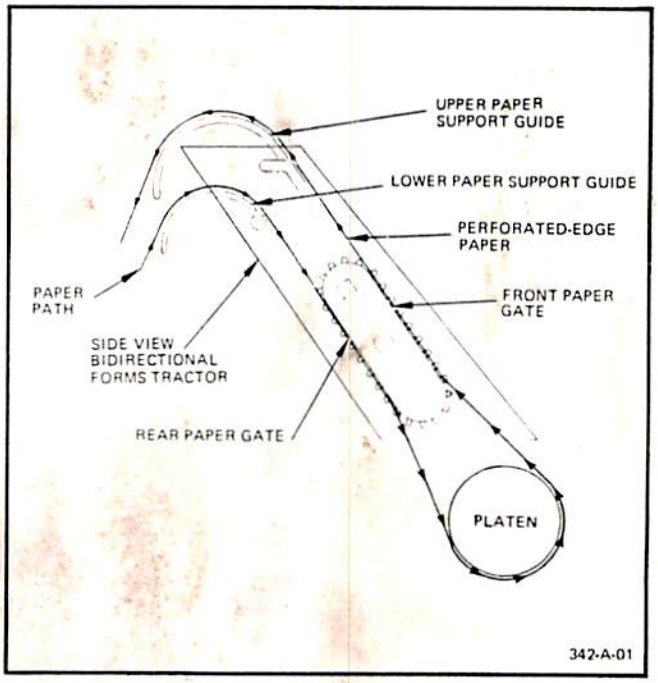

Figure 7. Paper Path

6. Open the rear paper gates and position each mechanism according to the paper width. Place the first two or three holes on each side of paper over the tractor pins. Position the paper so that the holes are approximately centered over the tractor pins. Close but do not lock the rear paper gates.

7. Ensure that the paper is lined up correctly to prevent improper feeding. The left edge of the paper should be aligned with the paper edge guide or paper out detector on the printer.

8. Carefully rotate and hand guide the paper through the platen. Return upper paper-support guide to its normal position.

9. Set the paper release lever **forward** so the paper can be drawn around the platen and up to the front paper gates.

10. Open the front gates and insert the paper holes over the corresponding tractor pins.

11. Close the paper gates. Rotate the platen to move the paper up and down to verify that it will not buckle or disengage from the pins.

12. Do not lock the paper gates until after the paper tension has been adjusted. Proceed to the next page.

PAPER TENSION ADJUSTMENT (All models)

1. After the paper is loaded move the paper tension lever upward (Figure 5) to remove paper slack. The paper should be snug, not tight. This lever applies tension equally to both the front and rear paper path.

2. Check tension adjustment by rotating the platen to move the paper up and down to verify the adjustment is set properly. Care must be taken to ensure that not too much tension has been applied, since this might cause excessive elongation of paper pin holes during operation. Loosen the paper tension lever and readjust (Step 1) if the paper is too tight.

3. Once the paper tension is adjusted properly, lock the paper gates into place by pushing the levers up.

4. Reinstall the access cover on the printer.

5. Paper tension may be readjusted at any time without unlocking the paper gates.

NOTE

The tractor operates with the printer's paper release lever and the bail set **forward** (towards the operator).

PROGRAMMING REVERSE PAPER MOVEMENT

For the most accurate line registration when feeding paper in the reverse or backward direction, a software "loop" resembling Figure 8 can be incorporated. The initial backward paper movement should overshoot the desired print line by two or three lines. The paper should then be fed forward to the desired print line. This will ensure that printing will occur only after the platen has rotated forward.

RETURNING COVER TO ORIGINAL HINGED CONDITION (Models with hinged covers)

Printers and terminals with **hinged** carriage area access covers may be returned to their original condition if the forms tractor is removed.

1. Remove cover. Slide cover inserts into place. Note the orientation in Figure 1.

2. Remove bidirectional tractor. Pull printer hinge arms all the way up.

3. Loosen hinge screws and slide cover onto hinge arms. The retainer clips go between the hinge arm and cover.

4. With one hand push and hold the retainer clip toward the front of the cover; holding the screwdriver in the other hand tighten the cover hinge screws. Close and open the top cover a few times to ensure that it has been properly installed. The READY lamp can not turn on unless the top cover is correctly installed and closed.

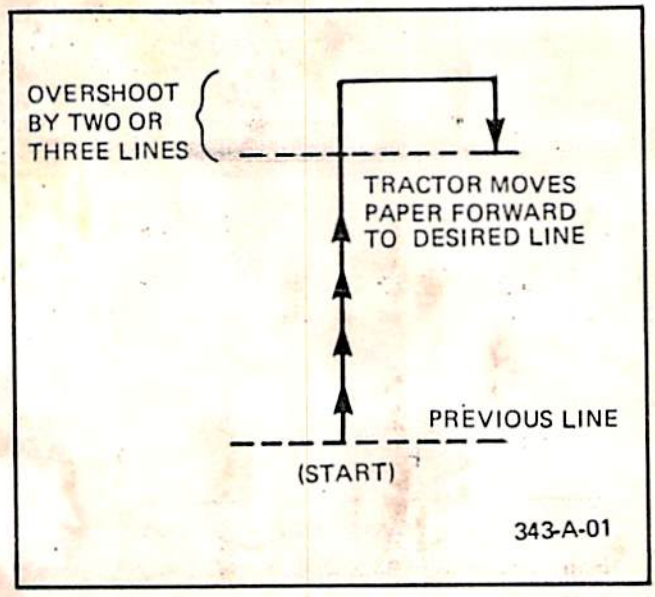

Figure 8. Reverse Paper Movement

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Manual

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PREFACE

This manual describes the installation and operation of the QUME CONNECTION IBM PC Centronics Model 1 module. The IBM PC Centronics module is one of a series of QUME CONNECTION modules designed to interface Qume printers to a wide variety of computer systems. The module easily plugs into the 50-pin edge-board connector mounted on the back of your Qume printer. Then the module's 25-pin shell connector is attached to the parallel port on the IBM's monochrome display and parallel printer adapter card. Once these connections are made and the DIP (Dual Inline Pack) switches on the printer and on the QUME CONNECTION are correctly set, your IBM PC can communicate with the Qume printer.

The QUME CONNECTION IBM PC Centronics interface, though especially designed for the IBM PC, is based on the "Centronics interface," a parallel data hardware interface developed by the Centronics Data Computer Corporation. Although the Centronics interface is not an official industry standard, the signal conventions are used by many computer and printer companies. If you unplug a Centronics dot matrix printer from your IBM system and plug in a Qume letter quality printer equipped with the QUME CONNECTION, the Qume printer will work.

The first section of this manual, **INSTALLING THE QUME CONNECTION**, describes how to install the QUME CONNECTION in the Qume printer and set the switches for proper operation with the IBM PC.

The second section, **IBM PC - QUME CONNECTION OPERATION**, will help you get a character from your computer into the printer and onto paper.

The third section, **PROGRAMMING THE QUME CONNECTION**, discusses the compatibility of the QUME CONNECTION command set with existing Qume and Diablo command sets.

The fourth section, **COMMAND SET**, describes each of the QUME CONNECTION program commands. Not everyone, of course, needs to understand these commands in a detailed fashion. If you only intend to use your Qume printer to print documents that you may have created with a commercially available word processing program, you may never need to worry about the Qume command set. The appropriate commands will have already been incorporated in your word processing software. However, if you intend to write your own software, would like to format your program listings, or are interested in the plotting and graphics capability of the printer, we recommend you read this section.

The **APPENDICES** contains the following technical information: an ASCII code chart, a sample basic formatting program, program mode carriage commands, a decimal/hex/ASCII conversion chart, a summary of the command set, and a description of the QUME CONNECTION interface signals.

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INSTALLING THE QUME CONNECTION IBM PC CENTRONICS MODEL 1 INTERFACE

Instructions for unpacking the Qume printer are provided with the printer. Follow those instructions and unpack the printer.

CAUTION

Make sure the metal shipping strap and the two mounting screws on the bottom of the printer, and the plastic carriage restraint (on the carriage rail) are removed before you operate the printer.

Make sure the AC power to the printer is turned off. Install The QUME CONNECTION in the printer. Do not connect the IBM PC to the printer at this time--the printer will be tested by itself first. The QUME CONNECTION module plugs into th# rear of the printer, as shown in the illustration below. Power is supplied to the QUME CONNECTION from the printer.

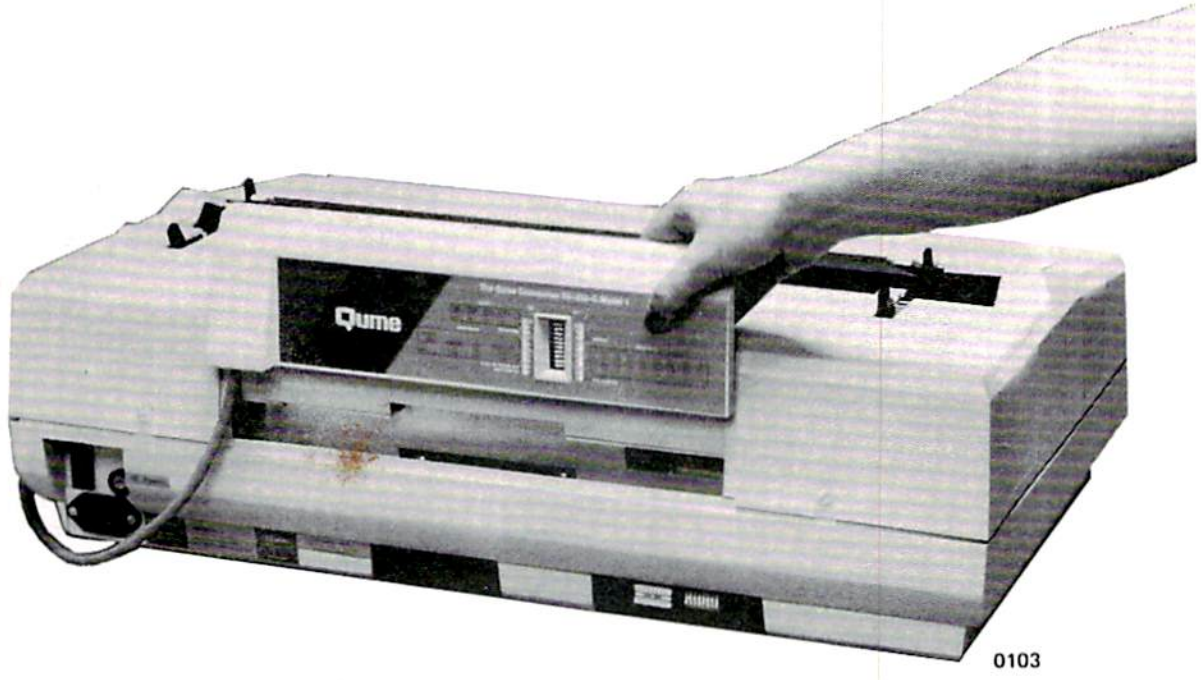


Figure 1. Installing the QUME CONNECTION on the printer

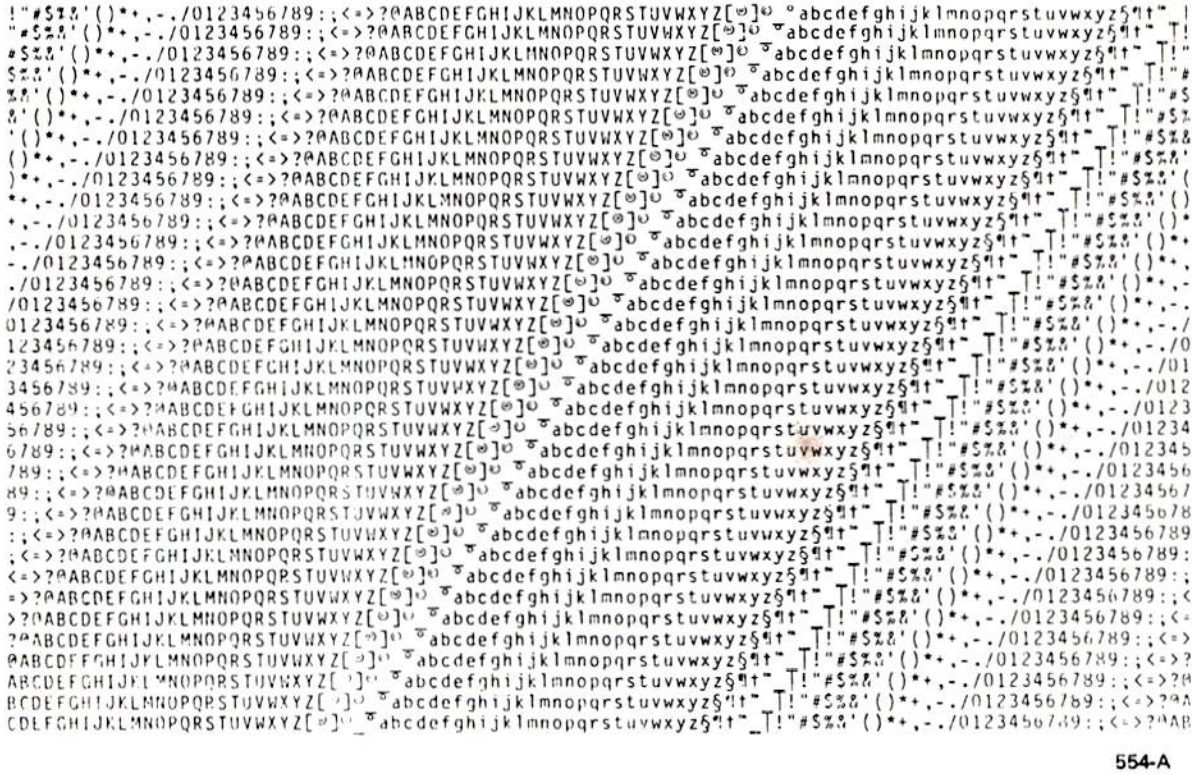
TESTING THE PRINTER

Test the printer before you connect it to your IBM PC. This will assure you that the printer works properly. Your Qume printer includes an internal diagnostic routine (Printer Self-Test) which tests the printer's basic electronic and mechanical functions. This routine is easily initiated via the front panel Form Feed switch. The QUME CONNECTION also provides a Self-Test (Terminal Self-Test) routine that tests the QUME CONNECTION circuitry in addition to verifying the electronic and mechanical functions of the printer. The existence of two Self-Test procedures greatly simplifies troubleshooting procedures. If the Printer Self-Test executes but the Terminal Self-Test does not, there is probably a problem in the interface module. If neither Self-Test works, the problem is most likely in the printer and not in the QUME CONNECTION module.

Before running either of the Self-Tests, ensure that a good ribbon, a print-wheel, and paper are installed in the printer. (The paper should be at least 12 inches wide. A WP printwheel must be installed to run the Printer Self-Test). A WP or WPS printwheel can be used for the Terminal Self-Test. Then turn off the power to the printer and proceed as follows:

Printer Self-Test

The Printer Self-Test, as shown in Figure 2, is executed by the printer's



554-A

Figure 2. "Barber Pole" Printout from Printer Self-Test

master microcomputer and exercises the printing mechanism and supporting electronics in your Qume printer. To start Printer Self Test, turn on the power to the printer while pressing the Form Feed switch. The Qume printer will perform an initialization sequence (you will see the carriage move to the left) and then will begin continuously printing lines of all of the characters on the printwheel in a "barber pole" swirl.

Note that the barber pole printing will always be in 10 pitch (10 characters per inch). Once the printer begins printing, you can release the Form Feed switch. The printer will continue printing until power is turned off or until the Form Feed switch is pressed and held as the printer completes a line of characters.

Terminal Self-Test

The Terminal Self-Test is a more extensive diagnostic test than the Printer Self-Test. Terminal Self-Test is executed entirely by the QUME CONNECTION's control microcomputer. Not only are the printing mechanisms exercised, but the terminal microcomputer and supporting circuits are also tested. Hence, successful completion of Terminal Self-Test indicates that both the printer and the QUME CONNECTION are functioning properly.

```
8-BIT PARALLEL (C) VERSION 1.3


INV. DATA STROBE: OFF

INHIBIT SEL/DESEL: OFF

INHIBIT DELETE: OFF

AUTO CR on LF or FF : OFF

STOP PRINT ON PAPER OUT: OFF

INHIBIT PRIME: OFF

AUTO CR & LF ON RIGHT MARGIN: OFF

BIDIRECTIONAL PRINTING: OFF

TWINTELLECT: OFF

LINES PER INCH: 6

AUTO LF on CR : OFF

FORM LENGTH: 3"

CHARACTER SPACING: 10

|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[•]©_°abcdefghijklmnopqrstuvwxyz§¶†¯
|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[•]©_°abcdefghijklmnopqrstuvwxyz§¶†¯
|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[•]©_°abcdefghijklmnopqrstuvwxyz§¶†¯
|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[•]©_°abcdefghijklmnopqrstuvwxyz§¶†¯
|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[•]©_°abcdefghijklmnopqrstuvwxyz§¶†¯
|!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[•]©_°abcdefghijklmnopqrstuvwxyz§¶†¯
```

760-A

Figure 3. Character Printout from Terminal Self Test

You can initiate a Terminal Self-Test by pressing and holding the Pause switch while the power to the printer is turned on. Once the Self-Test begins, release the switch. When the QUME CONNECTION's microcomputer receives a Self-Test command via the PAUSE switch, the module's microcomputer commands the printer microcomputers to execute an initialization sequence (the carriage should move to the left side of the printer). The terminal microcomputer then tests its Read Only Memory (ROM) with a checksum routine and tests its Random Access Memory (RAM) by writing bit patterns into memory and reading them back. If an error is detected in either ROM or RAM, the terminal's audible alarm will sound continuously and the test will halt.

The printer will then print the software version number, the current DIP switch settings, the current options selected, and finally lines of all the characters on the printwheel. Note that the binary representation of the module and the main board DIP switches begins with the highest switch (e.g., switch 10 on the QUME CONNECTION DIP switch; switch 8, "X", on the printer's main board DIP switch) and ends with the lowest (switch 1). The printout for front panel DIP switches A and B begins with switch 1 and ends with switch 4.

The character printout will continue until the power is turned off or until the PAUSE switch is pressed twice. Now, connect the printer to your IBM PC as described in the next section.

HOOKING UP THE PRINTER TO YOUR IBM PC

The QUME CONNECTION IBM PC Centronics Model 1 interface module accepts ASCII data in seven-bit parallel bytes (the printer ignores the eighth bit). The electrical connections are the same as those used by IBM's parallel printer. The QUME CONNECTION interface module does not require any extra cables or hardware modifications of your PC. Simply plug the QUME CONNECTION DB 25-pin plug into the parallel port on the IBM monochrome display and parallel printer adapter card. Note that the identification and timing of the parallel interface signals are described in Appendix G.

PRINTER SWITCH SETTINGS

The Qume SPRINT 11 PLUS printer is configured with DIP switches in two locations:

1. One eight-contact switch, located on the rear panel, controls the operations of the print carriage and the functions of multiple language interfacing;
2. Two four-contact switches, located at the right front panel under the printer top cover, control the forms length and character spacing features of the SPRINT 11 PLUS printer. Refer to Figure 4.

There are two important rules the printer follows with these switches:

1. The printer needs to be reset (power-up or software reset command) before the switches are read by the printer. If you change switch settings, the printer will not read the new setting until the printer is reset. PITCH, AUTO LF, and 6 or 8 LINES/INCH are the only exceptions to this rule; the printer reads the status of these switches constantly.

2. Although you will usually set printer functions via the DIP switches, many switch functions can also be set by a command sequence contained within a software application program. For example, the Auto Line Feed function can be turned on or off either by one of the DIP switches or by the IBM PC when it issues the proper command. Commands from your IBM PC will override the switch settings. When such a function command is received from your PC, the printer does not have to be reset before recognizing the change.

The manufacturer recommended setting for these switches is listed in parentheses at the end of the paragraph that describes the switch function.

FORM LENGTH - These four switches are set to the form length. (Mfg. setting: 11 inches.)

AUTO LF - Some software programs end a line of printing with a carriage return (CR) only. Unless a line feed (LF) is also issued to the printer, the paper will not advance. When Auto LF is selected ON, the printer will advance the paper one line whenever a carriage return is received--the printer adds the Line Feed. Select this function only if the text sent by your computer does not advance the paper at the end of a line (i.e., all the lines print on top of each other). Typically, the IBM PC automatically sends a line feed to the QUME CONNECTION. (Mfg. setting: ON.)

LINES PER INCH - Selects 8 or 6 lines per inch vertical spacing. (Mfg setting: 6 lines/inch.)

SPACING - These two switches determine the character spacing. There are four choices available: 10, 12, and 15 characters per inch (pitch) are used for fixed spacing printwheels (WP type), and WPS for proportional spacing printing. In fixed spacing printing each character occupies the same amount of space (1/10, 1/12, or 1/15 inch, as selected). In proportional spacing, the width of a character determines how much space it requires. For example, a W requires more space than a 1. If you install a WP printwheel and set the pitch DIP switches for WPS (or vice versa) the printout will appear scrambled or nonsensical. (Mfg. setting: 12 pitch.)

AUTO CR/LF - When selected ON, and when the printer carriage reaches either the right margin or right side of the printer frame, a carriage return/line feed will be automatically generated by the printer. If not selected, the carriage will remain at the right side until the PC sends a CR/LF. Only one line feed will be generated if this function and Auto LF are both selected. (Mfg. setting: OFF.)

AUTO BIDIRECTIONAL PRINTING - When selected ON, the printer will automatically print bidirectionally (in both directions across the paper). This allows for the fastest print speed. The IBM PC sends text

the same way for bidirectional printing as it does for printing in one direction. All of the bidirectional work is done by the printer. (Mfg. setting: ON.)

TWINTELLECT SWITCHES - These switches allow printwheels with special character sequences to be used. For most English language WP and WPS type printwheels, these four switches should be OFF. Select Twintellect only if you are using a special sequence printwheel. For details refer to the Printer Program Mode discussion in the COMMAND SET section. (Mfg. setting: OFF.)

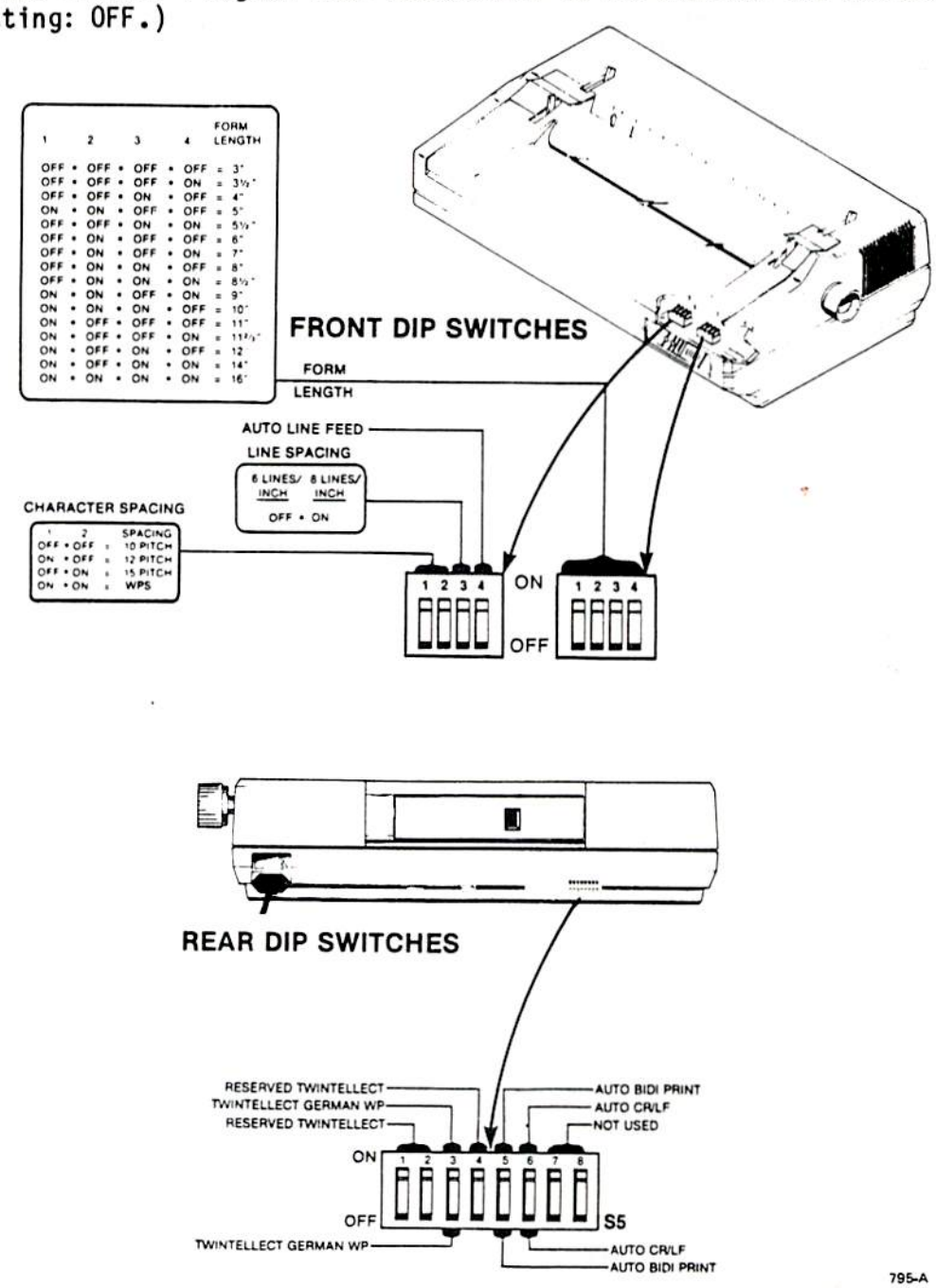


Figure 4.Printer DIP Switch Functions

QUME CONNECTION DIP Switches

Switch compatibility to an IBM connection is listed in parentheses at the end of each descriptive paragraph.

INVERTED DATA STROBE (Switch 10) - The QUME CONNECTION module has a set of 10 DIP switches. The top switch is used to set the polarity of the strobe pulse which latches data from your computer into the QUME CONNECTION. Set the DIP switch in the OFF position for a normal low-going pulse. The printer will not work if this switch is incorrectly set. (IBM setting: OFF.)

INHIBIT SELECT/DESELECT (Switch 9) - When this switch is OFF, the printer is selected or deselected whenever it receives the character 11H (DC1) or 13H (DC3) respectively. With this switch in the ON position, the 11H and 13H characters are interpreted as data rather than select/deselect characters. This switch is normally placed in the ON position. (IBM setting: ON.)

INHIBIT DELETE (Switch 8) - This switch selects the fate of a DELETE character when it is received by the QUME CONNECTION. DELETE may be ignored (Inhibit Delete ON) or DELETE may be used to reset the QUME CONNECTION (an internal software reset -- the printer will not lose a downloaded Twintellect table but all of the printing parameters such as tabs will be lost). Most letter quality printer software applications do not use the DELETE character. However, some software written for a dot matrix printer may use DELETE to reset the printer. (IBM setting: ON.)

AUTO CR ON LF OR FF (Switch 3) - When this function is selected, the printer performs a Carriage Return (move the carriage to the left margin) when a Line Feed or Form Feed is received. Some software applications do not issue a Carriage Return when a Line Feed or Form Feed is issued. (IBM setting: OFF.)

STOP ON PAPER OUT (Switch 2) - A paper out sensor must be installed (on Qume's optional bidirectional tractor). If a paper out sensor is not installed, this switch and function will be ignored by the QUME CONNECTION and printer.) When selected, printing will stop when the paper supply runs out. When not selected, printing will continue when the paper supply runs out. Regardless of switch position, when a sensor is present an audible alarm will sound momentarily when the paper supply runs out and pin 12 on the Interface Connector will go high. (IBM setting: OFF.)

INHIBIT PRIME (Switch 1) - The Prime or reset signal performs a printer initialization (the same as power-up). When this switch is OFF and Switch 9 (INHIBIT SELECT/DESELECT) is OFF, the printer will be reset when selected by the computer (i.e., Printer Select is active). If this switch is ON (Inhibit Prime), the printer will not be reset when the printer is selected. Obviously, if Switch 9 (INHIBIT SELECT/DESELECT) is ON, the setting of the INHIBIT PRIME switch is immaterial; the printer simply ignores the PRIME. Note that when the printer is initialized, all of the printing parameters are reset e.g., margins are set to zero, etc. (IBM setting: ON.)

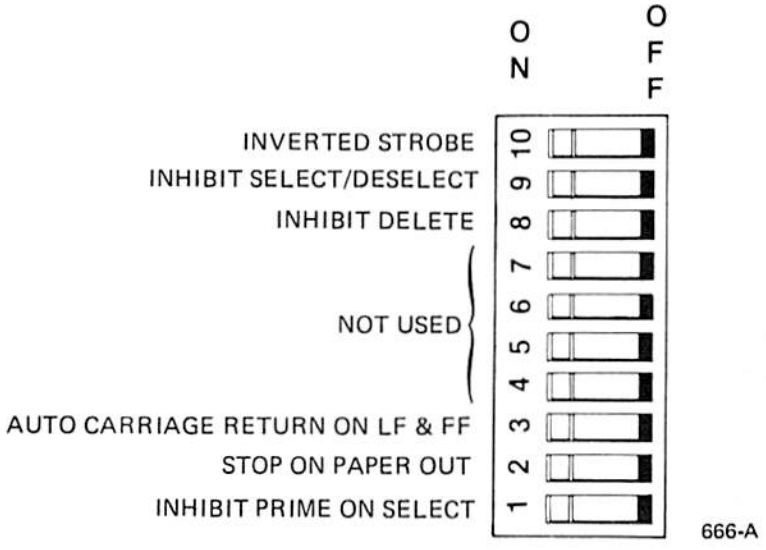


Figure 5. QUME CONNECTION DIP Switches

IBM PC - QUME CONNECTION OPERATION

Perform the following tasks prior to beginning your printing operation:

1. Connect the IBM PC interface module to the back of the printer.
2. Installed the correct printwheel, ribbon cartridge, and paper in the printer. Refer to the printer Operator Manual for instructions.
3. Connect the printer AC power cord to a nearby power outlet.
4. Verify the success of the Printer and Terminal Self-Tests.
5. Connect the QUME CONNECTION DB-25P male connector to the female connector on the monochrome display/parallel printer adapter card.
6. Correctly set the DIP switches on both the QUME CONNECTION and the Qume printer to match the requirements of the IBM PC.

With these procedures completed, you are ready to send characters from the PC to the printer. If you are using PC DOS or CP/M-86 as your operating system, any of the following techniques can be used to send information to the printer. Both of these operating systems automatically assume that the parallel port on the monochrome display/parallel printer adapter card is the default port. Consequently, there is no need to use any special commands to configure the printer port.

1. Pressing the **Shift** and **PrtSc** keys sends a "snapshot" of whatever is displayed on the monitor screen to the printer.

2. Pressing the **Control** and **PrtSc** keys toggles the printer port on and off. After you press these keys the first time, everything subsequently sent to the monitor screen will also be sent to the printer. To send the output only to the monitor screen, press these keys a second time. Note that for CP/M-86, pressing the **Control** and **P** keys produces the identical results.

3. From within Basic, the **LLIST** or **LPRINT** commands are used to direct output or program listings to the printer port. Basic does not know anything about the printer port, so it simply sends the character to be printed to your operating system (e.g., PC DOS). The operating system then directs the character to the printer port. Type the following Basic command to observe how this works:

   LPRINT "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG'S BACK"

If none of these commands gets the printer to print, recheck the setting of the DIP switches on the QUME CONNECTION module. If these are set correctly and the printer still doesn't print, insert your IBM diagnostic diskette and test the parallel printer adapter card. If the printer successfully executed the Terminal Self-Test diagnostics that you should have run earlier, it is highly unlikely that the problem is in the printer or QUME CONNECTION module.

PROGRAMMING THE QUME CONNECTION

QUME PRINTER COMMANDS AND SOFTWARE COMPATIBILITY

The following table describes the compatibility between the QUME CONNECTION IBM PC Centronics module and other types of printers:

Table 1. Printer and QUME CONNECTION IBM PC Centronics Module Compatibility

Printer	Compatibility

As described above, the command set used in the QUME CONNECTION is an expanded version of the commands used in Qume Sprint 5 and Sprint 9/45-55 terminal printers. Any software which drives any of these printers will run without modification on the QUME CONNECTION.

Other Qume printers: The command set used in the QUME CONNECTION module is an expanded version of the commands used in Qume Sprint 5 and Sprint 9/45-55 printers. Consequently, any software which drives any of these printers will run without modification on the QUME CONNECTION IBM PC Centronics module. One exception that should be noted is that unlike Qume's serial printers, the QUME CONNECTION IBM PC Centronics module cannot respond to STATUS REQUEST commands.

TTY: (e.g. Teletype Corp. Model 33): QUME CONNECTION will print all letters, numbers, and standard symbols (such as !@#$%¢&*()+="'?/.,). Most special control codes are ignored (see the QUME CONNECTION DIP switch section for details.

Dot Matrix printers: QUME CONNECTION will print all letters, numbers, and standard symbols. SPACE, LINE FEED, CARRIAGE RETURN, and FORM FEED are recognized. All other dot matrix special commands (such as elongated character printing) are ignored or used for different functions by Qume.

Diablo printers: (such as Model 630) QUME CONNECTION uses some of the same commands, but some are different. In general, you cannot use a software driver written for a Diablo printer with a Qume printer. In the description of the command set, a notation is given after each command which indicates whether the Qume command is also used by the Diablo 630 "Generic daisy wheel software" is frequently written which uses commands common to both Qume and Diablo.

To take advantage of the extensive command set in the QUME CONNECTION, the computer software needs to use the appropriate QUME CONNECTION commands. If you are primarily an end user of software, you may be able to "customize" your IBM PC software to use some of the QUME CONNECTION commands. It is unlikely that you will be able to make any major changes unless you have the source code to the software. Consult the software program manual to find out if the software can be customized. You would first run an installation program and select the Qume option (Sprint 5 or Sprint 9/45-55). That procedure initializes your software with the basic Qume Sprint 5 or Sprint 9/45-55 commands which are subsets of the QUME CONNECTION command set. After that, if

possible, you may be able to add several of the QUME CONNECTION commands. The commands which are not used by the Sprint 5 are identified in the Command Index on page 16 with asterisks (*) by the commands.

If you write software, the command set is described in the next section. A notation is given at the end of each command indicating the compatibility of the command with Qume Sprint 5 and Sprint 9/45-55 terminal printers as well as Diablo 630 printers. The format is as follows:

9 - The command is used by the Qume Sprint 9/45-55 terminal printer.
5 - The command is used by the Qume Sprint 5 terminal printer.
D - The command causes the same function to happen on the Diablo 630.

If there is no notation (e.g., the 5 is missing), it means the command is not used by that printer. A missing "D" for Diablo also means that the command may be used by Diablo for another printer function.

For example, **(9,D)** means that the command is used by the Qume Sprint 9/45-55 and Diablo 630 printers, but not by the Qume Sprint 5.

PRINTING CHARACTERS

A 96 character Qume printer has a printwheel with 96 characters. When your computer sends the printer any of the 94 ASCII codes 21 through 7E hex, the corresponding character is printed. For example, 41 hex prints an upper case "A". The two remaining ASCII codes, SPACE (20 hex) and DELETE (7F hex), are unique; SPACE is really a motion command and DELETE is frequently used to reset the printer. Consequently, a two code ESCape sequence is used to print the characters located at position 002 and 004 on the printwheel. See Special Character Printing in the COMMAND SET discussion for details.

As Qume manufactures over 100 different printwheels in many different languages, the character sequence is not identical for all printwheels. The QUME CONNECTION, however, has the intelligence to allow you to use all available printwheels. For standard sequence printwheels if the pitch setting (10, 12, 15 for WP type printwheels or WPS for WPS type printwheels) matches the printwheel, the printer knows exactly where to find the character on the printwheel.

Nonstandard sequence printwheels are supported by the Twintellect function. The printer's German Twintellect DIP switch allows the printer to access special look-up tables already present in ROM that support German WP and German WPS printwheels. It would be impossible, however, to store all the look-up tables required for every Qume printwheel. Instead, the QUME CONNECTION provides special commands that allow you to download to the printer the information necessary to support any other nonstandard printwheel. (See the Twintellect/Download Commands section for details).

THE COMMAND SET

This section describes in detail the QUME CONNECTION program commands. As mentioned in the PREFACE, your application may not require a working knowledge of these program commands. For example, if you are using a prepackaged word processing program, the software manufacturer may have already incorporated those commands required to drive the printer. Many of you, however, will use your Qume printer for a variety of applications and will want to know how to select special printing features such as bold printing and graphics. If you fall into this latter category, study the following sections carefully.

In addition to the printable characters, there are over eighty commands which are recognized by the QUME CONNECTION, ranging from SPACE to AUTOMATIC UNDERSCORE. Commands may be a single code, e.g., **LF** (line feed). Commands may also be sequences of two, three, four or more (e.g., relative motion commands, tab lists, downloads) codes. For the multiple code commands, you would send the printer the ESCAPE code (hex 1B) followed by one or more codes which tell the printer what to do. Some examples are:

ESC + The two code command for setting the top margin.
ESC SUB I A three code command for initializing the printer.
ESC F d1 d2 A four code command for setting form length. You supply two codes, **d1** and **d2**, to tell the printer the length.

Most commands begin with the **ESC**ape character (1B hex, 27 dec). The **ESC**ape character tells the printer that the next character or two are special commands. The third and possibly fourth codes are variables which pass printer parameters such as vertical and horizontal distances. These are identified as **d1, d2, n1,** etc.

When commands are sent, the printer can distinquish between upper and lower case. If the command calls for upper case, the computer must send the code for an upper case letter. **ESC E** is not the same as **ESC e.**

COMMAND FORMAT

Commands are presented in three forms:

1. ASCII CODES: **ESC +** means that the ASCII ESCape code is sent, and then a plus sign character is sent. These symbols may appear on your keyboard. To clarify our examples we show a space between characters; do not send this space as part of the command.

2. DECIMAL CODES: The equivalent decimal values for the command are given. This is useful for Basic programmers. ESCape is 27 decimal, and a plus sign is 43 decimal. A program using Microsoft Basic conventions would send these values (the **ESC +** command) to the printer as follows:

```
LPRINT CHR$(27);CHR$(43);
```

3. HEX CODES: Hex values for the command are given. For **ESC +** the hex codes are **1B** and **2B.**

Commands are organized in this manual according to the following table. Some commands are repeated because they logically fall into more than one category. An asterisk (*) indicates that the command is not used by the Qume Sprint 5.

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* Auto Line Feed On: ESC comma 19
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MARGIN COMMANDS

COMMAND:	ASCII CHAR:	HEX / DECIMAL
SET TOP MARGIN:	ESC +	1BH,2BH/27,43
SET BOTTOM MARGIN:	ESC -	1BH,2DH/27,45

These commands establish the top and bottom margins anywhere within the form length (the top margin cannot go below the bottom margin, obviously).

When the printer is powered up or initialized, the printer assumes the paper is at the top of form (the top edge of the paper); the default bottom margin is the form length set by the printer DIP switches. To set the top margin, the computer system sends a series of line feed commands which move the paper until the desired top margin line (the first line of actual printing) has been reached. Then the computer issues a SET TOP MARGIN command. For example, if the top margin is to be 12 lines down from the top of the paper, the computer sends 12 Line Feeds to the printer then sends a SET TOP MARGIN command. Appendix B provides a simple Basic formatting program that shows how to set the margin.

To set the bottom margin, the computer sends a series of line feeds which correspond to the maximum number of lines to be allowed on a page (assuming we are starting from the top margin, just set.) That moves the paper to where the bottom margin (last line of print) should be. Now the computer sends a SET BOTTOM MARGIN command. When the printer receives a paper feed command (including FORM FEED) which would advance the paper to the bottom margin, the printer will automatically advance the paper to the next top margin. It is not possible to print on the bottom margin.

SET TOP MARGIN and SET BOTTOM MARGIN commands are not affected by line spacing commands. (9)

SET LEFT MARGIN:	ESC 9	1BH,39H/27,57
SET RIGHT MARGIN:	ESC Ø	1BH,3OH/27,48

These commands set the left and right margins in the same way the top and bottom margins are set. The computer first issues a CARRIAGE RETURN command to move the carriage to the left most printing position (column 0), if the carriage is not already there from a power up. Then the computer sends horizontal move commands (such as SPACE) to move the carriage to the desired column and sends a SET LEFT MARGIN command.

To set the right margin, the computer sends horizontal move commands (such as a SPACE) to move the carriage to the desired column for the right margin and then sends a SET RIGHT MARGIN command.

At power-up or printer initialization, the left margin is the leftmost printing position (column 0), and the right margin is the right sideframe. The carriage will return to the left margin following a CARRIAGE RETURN, but the carriage can still be moved beyond the left margin with BACK SPACE and other leftward carriage move commands.

SET LEFT MARGIN and SET RIGHT MARGIN commands are not affected by character spacing commands. (5,9,D)

RIGHT MARGIN CONTROL ON: ESC O (letter) 1BH,4FH/27,79
RIGHT MARGIN CONTROL OFF: ESC Y 1BH,59H/27,89

If Right Margin Control is ON, the carriage will automatically perform a CARRIAGE RETURN after reaching the right margin Hot Zone.

The Hot Zone is a space equal to 5 character spaces preceding the right margin. A CARRIAGE RETURN and LINE FEED will be executed as soon as the first SPACE occurs within the Hot Zone. If a SPACE is not encountered in the Hot Zone, then the CARRIAGE RETURN and LINE FEED will execute as soon as a SPACE occurs after the right margin. If no SPACE occurs, then the CARRIAGE RETURN and LINE FEED will execute upon reaching the end of the platen. Note that the right margin location is not affected by the horizontal space increment definition (column width, pitch).

RIGHT MARGIN CONTROL commands are not affected by the AUTO LF mode. (9)

LINESPACING (VERTICAL) COMMANDS

DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS: ESC L d1 d2 — 1BH,4CH/27,76

Normally, the line feed distance is set by the printer which reads the DIP switches (6 or 8 lines per inch) upon power up or printer initialization. However, line feed distance may also be set by a software command from the computer.

This four code command is used to define the line feed distance in 1/48 inch increments. To find **d1** and **d2** you must first know the line feed distance in 1/48 inch increments. For example, 3 inches = 144/48 inches.

d1 is the hex equivalent of the tens; **d2** is the ones.

In the example above, there are 14 tens in 144. (The integer of 144/10 is 14.) 14 decimal = E hex. Hence, **d1** is E. **d2** is **4**. Consequently, the computer sends the printer **ESC L E 4**, a sequence of four ASCII characters. When the line feed distance is 99/48 inch or less, no hex conversion is necessary since 0 to 9 is the same in hex or decimal.

Invalid parameters are ignored; maximum distance is 159/48 inches. If either **d1** or **d2** is zero, the digit **0** must be entered. You must, for example, send **09** and not **9.** (5,9)

This command does not affect the margins or the absolute value of the form length.

DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS, ALTERNATE: ESC RS (distance + 1) — 1BH,1EH/27,30

This command provides another method of defining line spacing, but the maximum distance is 125/48 inch.

For example, 1/4 inch = 12/48 inch. Add 1 to 12 = 13. The computer sends ESC RS (13), or 1B 1E 0D hex.

The equivalent Basic command would be **LPRINT CHR$(27);CHR$(30);CHR$(13);**

(5,9,D)

SET FORM LENGTH: ESC F d1 d2 — 1BH,46H/27,70

Normally, form length is set by the printer DIP switches, which are read on power-up or printer initialization. However, the form length may also be set by software command from the computer.

Form length may be a distance of 1/6 inch to 127/6 inches (21 1/6 inches). **d1** and **d2** are determined the same way as the LINE FEED INCREMENTS above, except that 1/6 inch increments are used, not 1/48 inch.

d1 represents the hex character of the tens. **d2** is the ones. For example, a form length of 17 inches = 102/6 inches. 102 has 10 tens and 2 ones. Therefore, **d1** = A (the hex equivalent of 10 decimal), and **d2** = 2. The computer sends ESC F A 2.

Whenever the form length is changed, the current vertical position is set as the top of form and the top margin. The bottom margin is set at the end of form.

Note that before the SET FORM LENGTH command is sent, you should physically adjust the paper to the top of form because the printer is going to assume the current paper location is top of form. (5,9)

AUTO CARRIAGE RETURN/LINE FEED ON: ESC W 1BH,57H/27,87
AUTO CARRIAGE RETURN/LINE FEED OFF: ESC Z 1BH,5AH/27,90

Normally, this function is selected by a printer DIP switch. The computer may also select or change this function.

Selecting AUTO CARRIAGE RETURN/LINE FEED (on) will cause the printer to automatically perform a CARRIAGE RETURN and a LINE FEED when the carriage reaches the right margin (or right printer side if right margin is not set).

If the printer is in either Graphics mode, the Auto Carriage Return/Line Feed mode is ignored. (9)

AUTO LINE FEED ON: ESC comma 1BH,2CH/27,44
AUTO LINE FEED OFF: ESC period 1BH,2EH/27,46

Normally, this function is selected by a printer DIP switch. The computer may also select or change the function.

When AUTO LINE FEED is selected (ON) and the printer receives a CARRIAGE RETURN, the printer will also perform a LINE FEED. This is an extremely useful function if the computer sends only a CARRIAGE RETURN at the end of a line. If this function is selected and the computer sends a CR and LF, the printer will add another LF and double space the print. (9)

CHARACTER SPACING (HORIZONTAL) COMMANDS

DEFINE HORIZONTAL SPACE INCREMENTS: ESC E d1 d2 1BH,45H/27,69

This command changes the distance the carriage moves after a character is printed or whenever the computer issues a SPACE or BACKSPACE command. This distance is normally determined by the pitch setting from the printer DIP switches. For 10 pitch (10 characters per inch) printwheels, the carriage moves 1/10 inch. In WPS mode carriage movement is proportional to the width of the character, and SPACE and BACKSPACE commands always cause the carriage to move 1/12 inch.

The distance of this horizontal movement is changed by the computer when a DEFINE HORIZONTAL SPACE INCREMENT command is issued. This command will override the previous setting (DIP switch or command). A maximum increment of 159/120" is possible.

d1 and **d2** are determined in the same way as the line feed spacing, except that the distances are in 1/120 inch instead of 1/48 inch.

d1 represents the hex character of the tens; **d2** is the ones.

Since this command defines spacing, it will also affect the location of tabs. For further important information on this subject, refer to the HORIZONTAL TAB STOP command description. (5,9)

DEFINE HORIZONTAL SPACE INCREMENTS
ALTERNATE: ESC US (distance + 1) 1BH,1FH/27,31

This command defines the SPACE distance the same way the ALTERNATE VERTICAL SPACING (LINE FEED) INCREMENT, ALTERNATE works. The horizontal distance is measured in 1/120 inches. This command allows a maximum increment of 125/120". Refer to the DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS, ALTERNATE section for details on calculating the distance parameter in this command. (5,9,D)

WPS ON: ESC $ 1BH,24H/27,36
WPS OFF: ESC % 1BH,25H/27,37

Normally, pitch (character spacing) is determined by the setting of the printer DIP switches. The pitch must match the type of printwheel used. WP printwheels use 10, 12, or 15 pitch; WPS printwheels are used for proportional space printing and must use the WPS setting. Proportional spacing means that the space a character occupies depends on the width of the character. For example, the letter M is wider than the number 1; therefore, the carriage moves more for an M than for a 1. Using these commands, your computer can turn WPS on or off. Note that these commands take precedence over the setting of the pitch DIP switches.

Columns are established and defined at 12 pitch or according to the DEFINE HORIZONTAL SPACING INCREMENTS command. (9,D)

TAB COMMANDS

SET HORIZONTAL TAB STOP: ESC 1 1BH,31H/27,49
CLEAR HORIZONTAL TAB STOP: ESC 8 1BH,38H/27,56

The Qume printer has electronic tabs in the same way a typewriter has mechanical tab stops. The computer may set or clear the tabs by command. Tabs are column dependent, and their physical position across the page will be a function of the pitch setting (character spacing). For example:

- At 10 pitch there are a total of 132 possible tabs.
- At 12 pitch there are a total of 158 possible tabs.
- At 15 pitch there are a total of 197 possible tabs.

Tabs will always track the pitch setting. A tab set at column 50 will always be at column 50. If a tab is set for column 150 at 12 pitch, and the pitch is changed to 10 characters per inch, the tab will be moved beyond the right end of the platen since there are only 132 tab positions at 10 pitch. In this case, a tab to column 150 will cause the carriage to move to column 132, or the last column on the page. You should anticipate this effect when changing pitch (character spacing). Remember that the printer stores the tabs as column numbers and not as physical locations. The maximum number for a tab stop column is 200. Columns after number 200 cannot be used for tab stops.

To set a tab stop, the computer moves the carriage to the desired column and then issues the SET HORIZONTAL TAB STOP command. To clear an individual tab stop, a CLEAR HORIZONTAL TAB STOP is sent instead of the SET command. (5,9,D)

CLEAR ALL HORIZONTAL TAB STOPS: ESC 2 1BH,32H/27,50

This command will clear all horizontal tab stops. The printer clears the tab stops by erasing a table in its memory. Tab stops will also be cleared following a restore command or when the printer is powered up. (5,9,D)

SET TAB LIST: ESC (list 1BH,28H/27,40
CLEAR TAB LIST: ESC) list 1BH,29H/27,41

This command allows the computer to set or clear up to 159 tabs at one time. To implement the SET TAB LIST function, the computer transmits ESC (, and then follows with a series of two digit values from 00 to F9, where the first character is the hex equivalent of the tens and the second is the ones. This value is not a hex value (e.g., F0 is NOT 240 decimal) but the same value used in the vertical line spacing command. Each value represents a column where a tab is to be set. After each value, the computer must transmit an ASCII comma, and the last value must be followed by an ASCII period.

For example:

- Set tab stops at columns 05, 43, 79 104, 109 (all decimal).
- The characters to be sent will be 05, 43, 79, A4, A9.
- The command is ESC (0 5 , 4 3 , 7 9 , A 4 , A 9 .
- In Basic, the command would be as follows:

```
LPRINT CHR$(27);CHR$(40);"05,43,79,A4,A9.";
```

Tab stops set in this manner are subject to the same factors that affect the SET HORIZONTAL TAB STOP command. Refer to that command description for important details. Tab stops set in this manner may be listed in any order. (5,9)

ABSOLUTE VERTICAL TAB TO A LINE NUMBER: ESC P d1 d2 1BH,50/27,80

This command moves paper either up or down to a line number specified by **d1 d2**, a two digit number which can define a maximum of 127 line locations. **d1** and **d2** are the hex value of the tens and the value of the ones, respectively (the same as the LINE SPACE INCREMENT value used earlier). Line numbering begins at the Top of Form, Line 00. For example, to move the paper to Line 117:

d1 is 11 tens, or B in hex; **d2** is 7. The command is **ESC P B 7.**

This command is directly or indirectly affected by the following:

- LINE SPACE switch setting
- DEFINE VERTICAL SPACE INCREMENT: ESC L d1 d2
- DEFINE VERTICAL SPACE INCREMENT, ALTERNATE: ESC RS (n)
- FORM LENGTH switch settings
- SET FORM LENGTH: ESC F d1 d2
- SET BOTTOM MARGIN: ESC -
- SET TOP MARGIN: ESC + (5,9)

ABSOLUTE VERTICAL TAB TO A LINE NUMBER
ALTERNATE: ESC VT (distance + 1) 1BH,0BH/27,11

This method of moving the paper to a line number uses the same method as the alternate method of specifying the line spacing used earlier. The command defines a maximum line number of 125.

For the example, to move the paper to line 117, the Basic command is

```
LPRINT CHR$(27);CHR$(11);CHR$(118);
```

This command is directly or indirectly affected in the same manner as the ABSOLUTE VERTICAL TAB TO A LINE NUMBER: ESC P d1 d2 command. (5,9,D)

PAPER MOVEMENT (VERTICAL MOTION) COMMANDS

LINE FEED: LF 0AH/10

Paper is moved one linespace. The line feed distance is determined by one of the following:

- LINE SPACE switch setting
- DEFINE VERTICAL SPACE INCREMENT - ESC L (d1) (d2)
- DEFINE VERTICAL SPACE INCREMENT, ALTERNATE - ESC RS (n)

In both GRAPHICS ON modes (1/60" and 1/120") LINE FEED distance equals 1/48". (5,9,D)

NEGATIVE LINE FEED: ESC LF 1BH,0AH/27,10

This command will cause the paper to move backward to the previous line. The negative line feed distance is determined by the same commands which define the line feed distance. In both GRAPHICS ON modes (1/60" and 1/120") negative line feed distance equals 1/48". (5,9,D)

1/2 LINE FEED: ESC U 1BH,55H/27,85

Paper is moved one-half linespace. This command is frequently used for subscripts. If the line feed distance has been defined as an odd number of 1/48 inch increments, then a 1/2 LINE FEED command will move paper half the line feed distance rounded down to the next lowest 1/48" increment. (5,9,D)

NEGATIVE 1/2 LINE FEED: ESC D 1BH,44H/27,68

Paper is moved one half linespace in the direction opposite to a LINE FEED operation. This command is frequently used for superscripts. If the line feed distance has been defined as an odd number of 1/48 inch increments, then a NEGATIVE 1/2 LINE FEED command will move paper one half the line feed distance rounded down to the next lowest 1/48" increment. (5,9,D)

AUTO CARRIAGE RETURN/LINE FEED ON: ESC W 1BH,57H/27,87
AUTO CARRIAGE RETURN/LINE FEED OFF: ESC Z 1BH,5AH/27,90

The AUTO CARRIAGE RETURN/LINE FEED ON command causes the printer to automatically issue a carriage return/line feed when the printer carriage reaches either the right margin or right side of the printer frame. If this command is turned OFF, the carriage remains at the right side of the printer frame until the computer sends a CR/LF. Note that only one line feed is generated if both this function and AUTO LF are both selected. (9)

RELATIVE VERTICAL (PAPER FEED) MOTION: ESC V n1 n2 n3 1BH,56H/27,86

This command moves paper up or down in increments of 1/48", to a maximum of 1791/48" (37.3"). **n1 n2 n3** is the hex value of the distance represented by 3 ASCII characters. The characters used for the hex value are offset by an ASCII bias:

1. **n1** is the number of 256's plus: ASCII '@' (40 hex), for right or up; ASCII 'P' (50 hex), for left or down.

2. **n2** is the number of 16's plus ASCII '@' (40 hex).

3. **n3** is the number of ones plus ASCII '@' (40 hex). (5,9)

Our example will show how to move the paper up a distance of 10 inches (from its current line number).

1. First determine the number of 1/48" in 10": 480.

2. 480 = (1 x 256) + (14 x 16) + (0 x 1). The three values will be based on the underlined numbers 1, 14, and 0.

3. Convert 1, 14, and 0 decimal to hex base: 1=1, 14=E, 0=0. These two steps converted 480 decimal to 1E0 hex.

4. Add 40 hex: 1+40=41 (the n1 value). E+40=4E (the n2 value); 0+40=40 (the n3 value).

5. The command is ESC V A N @, or hex: 1B 56 41 4E 40

FORM FEED: FF 0CH/12

This command moves paper to the next top of form. If top and bottom margins are set, the paper will move to the top margin of the next form. The form length distance is determined by one of the following:

- FORM LENGTH switch setting (printer DIP switches)
- SET FORM LENGTH: ESC F d1 d2 program command.

A FORM FEED will terminate the Underscore mode.

If Qume's Mechanical Sheetfeeder is installed on the printer, a FORM FEED command will automatically eject the sheet of paper currently in the printer, load the next sheet of paper, and move the loaded sheet of paper to the desired print position. (5,9,D)

CARRIAGE MOVEMENT (HORIZONTAL MOTION) COMMANDS

HORIZONTAL TAB: HT 09H/9

This command causes the carriage to move to the first set tab stop to the right.

If no tab stops have been set to the right of the current carriage position, the carriage will move to the end of the platen. (5,9,D)

ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER: ESC C d1 d2 1BH,43H/27,67

This command works the same way as the ABSOLUTE VERTICAL TAB TO A LINE NUMBER command. This command moves the carriage to a specific column with the range of 0 to 159. **d1 d2** is a two digit number that can represent any column in this range. **d1** is the hex value of the tens; **d2** is the value of the ones. As an example, to move the carriage to column number 130:

d1 is 13, which is hex C. **d2** is 0.

The command is ESC C C 0. In Basic: **LPRINT CHR$(27);"CC0";**

Columns are space distant dependent. An ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER is therefore affected by the same switches and set-up and define commands that affect the SPACE command. Refer to the SPACE command for detailed information. Any attempt to tab to a column number beyond the right end of the platen will cause the carriage to move to the right end of the platen.

In the WPS mode, columns are defined at 12 pitch or according to the DEFINE HORIZONTAL SPACING INCREMENTS command.

HORIZONTAL TAB commands are affected by, or affect, the following:

- SET HORIZONTAL TAB STOP: ESC 1.
- TAB SET LIST: ESC (list
- DEFINE HORIZONTAL SPACING INCREMENTS: ESC E d1 d2
- DEFINE HORIZONTAL SPACING INCREMENTS, ALTERNATE: ESC US n
- PITCH switch
- Motion minimization
- AUTO UNDERSCORE mode. (5,9)

ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER
ALTERNATE: ESC HT (column number + 1) 1BH,09H/27,9

This command moves the carriage to a specific column within the range of 0 to 125. For example, the following Basic commands move the carriage to column 56.

```
DISTANCE = 56 + 1
LPRINT CHR$(27);CHR$(9);CHR$(DISTANCE);     (5,9,D)
```

RELATIVE HORIZONTAL CARRIAGE MOTION: ESC H n1 n2 n3 1BH,48H,27,72

This command works the same way as the RELATIVE VERTICAL MOTION command. This command moves the carriage left or right any number of 1/120" increments between 0/120" and 1584/120". Refer to the examples in the RELATIVE VERTICAL MOTION command to determine **n1 n2 n3.**

Commands which would cause the carriage to move beyond the platen limits are ignored. Motion minimization is in effect. (5,9)

BACKWARD PRINT: ESC 6 1BH,36H/27,54

This command reverses the normal carriage motion direction. The BACK SPACE will cause the carriage to move from left to right. The HORIZONTAL TAB, RELATIVE HORIZONTAL CARRIAGE MOTION, and ABSOLUTE HORIZONTAL TAB commands are not affected. In addition, this command does not alter any vertical motion direction.

This command is terminated by the FORWARD PRINT command or a CARRIAGE RETURN command. If the CARRIAGE RETURN is used to terminate backward printing, the carriage will return to the left margin. (5,9,D)

FORWARD PRINT: ESC 5 1BH,35H/27,53

This command is used to terminate the BACKWARD PRINT mode commands. (5,9,D)

AUTO BIDIRECTIONAL PRINTING ON: ESC < 1BH,3CH/27,60
AUTO BIDIRECTIONAL PRINTING OFF: ESC > 1BH,3EH/27,62

These commands place the printer in the Automatic Bidirectional Printing mode. This function is normally selected by a DIP switch, but the function may also be selected or changed by the computer.

The printer is more efficient if it prints in both directions. To do this received characters are stored in a buffer in the printer until a CARRIAGE RETURN or LINE FEED character is received (indicating the end of a line of text). Then the printer actually prints the line. For the bidirectional mode to work the printer buffer has to be kept partially full. If the printer processes all of the characters in the buffer, it will move the carriage back to the left margin when it finds the CARRIAGE RETURN character. None of this work is of any concern to your computer system; it is all done inside the printer. Bidirectional printing may be turned off either by the DIP switch on the printer or by this command.

The AUTO BIDIRECTIONAL PRINTING command takes precedence over the setting of the AUTO BIDIRECTIONAL PRINTING switch. Also note that when UNDERSCORE ON or tabs are used, the carriage moves only from left to right. (9)

SPACE: SP 20H/32

This is the standard command which moves the carriage one space (between words, for example). There is nothing complicated about the command but the printer follows rules in determining how far and in what direction the carriage is going to be moved:

- The PITCH switch determines the distance of a column width. In 10 pitch the distance will be 1/10 inch; for 12 pitch 1/12 inch; for 15 pitch 1/15 inch; for WPS (proportional spacing) 1/12 inch.

- DEFINE HORIZONTAL SPACING INCREMENT commands will override the pitch switch or the previous setting.

- A SPACE in the BACKWARD PRINT mode will move the carriage to the left.

- Commands which affect the SPACE distance and direction are:

  AUTO CARRIAGE RETURN/LINE FEED switch
  AUTO BIDIRECTIONAL PRINTING switch
  AUTO BIDIRECTIONAL PRINTING ON: ESC <
  BACKWARD PRINT: ESC 6, or FORWARD PRINT: ESC 5
  AUTO CARRIAGE RETURN/LINE FEED ON - ESC W
  GRAPHICS ON 1/60": ESC 3, or GRAPHICS ON 1/120": ESC G
  RIGHT MARGIN CONTROL ON: ESC O (5,9,D)

BACKSPACE: BS 08H,8

This command causes the carriage to move one space in the opposite direction of SPACE. Normally BS moves the carriage to the left (except in backward print mode). Back space distance and direction are affected by the same control switches and commands as the SPACE command. Note that in the WPS mode, all backspace commands are fixed at 1/12". Do not confuse backspace with DELETE or RUBOUT. (5,9,D)

BACKSPACE 1/120": ESC BS 1BH,08H/27,8

This command causes the carriage to move 1/120" (normally to the left). Setting the horizontal increment to 1 and using BACKSPACE provides equivalent movement. (5,9,D)

CARRIAGE RETURN: CR 0DH/13

This is the standard "end of line" command. This command causes the carriage to move to the left margin. The CARRIAGE RETURN command terminates the following printer modes:

GRAPHICS ON, 1/60": ESC 3
GRAPHICS ON, 1/120": ESC G;
BACKWARD PRINT: ESC 6

The CARRIAGE RETURN affects, or is affected by, the following functions:

AUTO CARRIAGE RETURN/LINE FEED switch and command
AUTO BIDIRECTIONAL PRINTING switch and command
RIGHT MARGIN CONTROL ON: ESC O
UNDERSCORE ON: ESC I.

Refer to the appropriate control switch or command description for more detailed information. (5,9,D)

PRINTING COMMANDS

UNDERSCORE ON: ESC I 1BH,49H/27,73
UNDERSCORE OFF: ESC J 1BH,4AH/27,74

In the Underscore (underline) mode, the printer will automatically underscore characters, words, phrases, sentences, paragraphs, etc. as identified by the host system.

When the Underscore mode is turned ON, the printer will underline all text following the UNDERSCORE ON command until the UNDERSCORE OFF command is received.

The printer does not underline each character as received but waits until it receives a Carriage Return, any paper motion command, or UNDERSCORE OFF and goes back and underlines all of the text which is to be underlined.

The following functions will also occur:

- Horizontal space that is tabbed over will be underscored.
- Bold Overprint mode ON will cause multiple strike underscores.
- Moving the carriage to the left of the Underscore mode "start" point before causing underscore execution may have unexpected results. (5,9)

BOLD OVERPRINT ON: ESC K d 1BH,4BH/27,75
BOLD OVERPRINT OFF: ESC M 1BH,4DH/27,77

This command will cause the print hammer to fire **d** times for each printed character before the carriage is moved to the next character's position. **d** is a number between 1 and 4. The procedure for overprinting text three times is:

- Send an ESC K 3, or **LPRINT CHR$(27);CHR$(75);"3";**
- All of the text will be overprinted 3 times until BOLD OFF is sent or until d is changed.

SHADOW PRINT ON: ESC Q 1BH,51H/27,81
SHADOW PRINT OFF: ESC R 1BH,52H/27,82

This command will cause all characters to be printed twice, with the second printing occuring 1/120" from the first. The darker headings in this manual are printed with shadow print. What word processors and similar software call "bold" may actually be shadow print.

After SHADOW PRINT ON is sent, all text will be printed with shadow print until SHADOW PRINT OFF is received.

The printer observes the following rules:

WPS mode: Spacing is not adjusted to accommodate the additional 1/120" displacement. Consequently, a line of WPS text will be longer when SHADOW PRINT is ON than when SHADOW PRINT is OFF.

Non-WPS mode printing: Character spaces will be reduced to maintain column integrity.

Backward Printing mode: The primary character is printed first, then the shadow character.

In Bold Overprint mode and Shadow Print Mode: The first character will overprint, the second will single print.

(9)

NO PRINT ON: ESC S 1BH,53H/27,83
NO PRINT OFF: ESC T 1BH,54H/27,84

The NO PRINT ON command will inhibit the firing of the print hammer and the operation of ribbon feed and printwheel motors during the printing of characters, without affecting any other function. NO PRINT is used to mask passwords, etc. NO PRINT OFF is normal. (9)

GRAPHICS COMMANDS

Qume's letter quality printers are typically used for preparing text. However, the printer can also be used for graphics. It recognizes a set of graphics commands which allows resolution of 60 or 120 points per inch horizontally and 48 points per inch vertically (5760 points per square inch). Use of the Bidirectional Tractor enhances printer registration. The basic graphics commands are as follows:

GRAPHICS ON 1/60: ESC 3 Horizontal movements of 1/60 inch.
1BH,33H/27,51
GRAPHICS ON 1/120: ESC G Horizontal movements of 1/120 inch.
1BH,47/27,71
GRAPHICS OFF: ESC 4 Ends both graphics modes; normal print.
1BH,04H/27,4 (5,9,D)

The printer follows these rules in the graphics modes:

1. SPACE and BACKSPACE move the carriage 1/60 or 1/120 inch horizontally, as selected by the GRAPHICS ON command.
2. LINE FEED and NEGATIVE LINE FEED commands move paper 1/48 inch vertically regardless of the horizontal mode.
3. CHARACTER PRINTING commands will not move the carriage after the character is printed. AUTO LF and AUTO CR/LF modes are ignored.

All other commands, including set up and define commands, are unaltered.

To program in GRAPHICS MODE, first select the horizontal step (1/60 or 1/120 inch). The four carriage movement commands can be used as "cursor control" to move the paper and carriage to the desired location: SPACE (right movement), BACKSPACE (left), LINE FEED (down), and NEGATIVE LINE FEED (up). After the correct position is reached, the printer is sent a character (typically a period to print a dot). The paper and carriage are not moved. Thus, you must program (1) paper and carriage movement, and (2) printing in the graphics mode.

Graphic mode is terminated by GRAPHICS OFF, CARRIAGE RETURN, or INITIALIZE PRINTER commands, or by turning the printer power off and on.

NO CARRIAGE MOVEMENT ON NEXT CHARACTER ONLY: ESC N 1BH,4EH/27,78

This command is used to inhibit carriage motion after printing a character. This command is useful for underscoring, slashing zeroes (Ø), forming composite symbols or foreign language characters, etc. When using proportional spacing, send the wider of the two characters first. The **ESC N** command must be sent before the character that is to have its automatic spacing inhibited. **ESC N** is obviously affected by the graphics commands as the carriage never moves after printing a character in graphics mode; carriage motion must be separately programmed.

For example, the following Basic line will cause a zero to be printed with a slash through it: **LPRINT CHR$(27);"NO/";** The carriage will then move to the next position on the paper. (5,9)

PRINTER PROGRAM MODES

When the printer receives a character for printing, it has an internal look-up table which indicates the (1) Hammer Intensity, (2) Ribbon Advance, (3) Carriage Motion, and (4) Printwheel Position. For most users and most applications, this standard printing mode is used. There are some unique applications where it is necessary to program these four parameters. For example, if special character sequence printwheels are used, the printer must be told where characters are located on the printwheel.

There are three do-it-yourself modes available:

1. Program Mode - You specify the hammer intensity, ribbon advance, carriage distance and direction, and the ASCII code for each character to be printed. The chart in Appendix C may be used to identify correct values.

2. Secondary Program Mode - The same as Program Mode except that the carriage distance and direction are determined from the pitch setting and are not controllable.

3. Twintellect - Similar to Program Mode with two important differences. First, you specify hammer intensity, ribbon advance, character code, printwheel position, and character width (not carriage motion). Second, the values are loaded into the printer once (usually during printer set-up routines) and the printer stores the values in a lookup table. Before a character is printed, the printer looks up the parameters in the table in its memory. In the Program Mode you must send these parameters in a separate byte after each character. In the Twintellect mode the parameters are loaded into a table in the printer's memory.

PROGRAM MODE

SHIFT TO PROGRAM MODE: ESC SO 1BH,0EH/27,14
RETURN TO NORMAL MODE: ESC SI 1BH,0FH/27,15

This command places the printer in the Program mode and allows the host system to explicitly control the following functions for every character to be printed:

HAMMER INTENSITY. Intensities can be programmed from a minimum value of 1 to a maximum value of 7. A value of 0 defaults the intensity to the printer's normal internal value.

CARRIAGE MOTION. Distance can be from 0/120 inch to 15/120 inch.

PRINTWHEEL POSITION. As determined by the ASCII code.

This mode permits the use of special nonstandard sequence printwheels. The information necessary for: (1) locating a specific character spoke on the printwheel, (2) setting the proper hammer intensity, and (3) providing the proper character spacing, must be derived from data supplied with the special printwheel.

To implement this mode, the user must:

1. Enter the Program mode by sending the ESC SO command to the printer.

2. Send the ASCII code for the character to be printed.

3. Refer to the Appendix and derive the desired hammer intensity, and carriage spacing programming ASCII character.

4. Send the special programming ASCII character.

As an example of the use of Appendix C, assume that the character requires a hammer intensity of 4 and a spacing increment of 12/120". The special programming mode character will be an **L**. After entering the Program Mode (ESC SO), the computer sends the character followed by the printing information (**L**) for that character, then another character followed by its print information, and so on. (5,9,D and 5,9)

SECONDARY MODE

ENTER SECONDARY PROGRAM MODE: ESC # 1BH,23H/27,35
RETURN TO NORMAL MODE: ESC SI 1BH,0FH/27,15

This mode is similar to the Program Mode except that ribbon movement can be programmed independently, and carriage motion cannot be programmed. Carriage motion in this mode must be commanded using the PROGRAM MODE CARRIAGE COMMAND (US d). After entering the Program Mode an alternate method can be used to control printing parameters:

HAMMER INTENSITY. Relative hammer intensity can be selected from a minimum of 1 to a maximum of 7. If an intensity of zero is selected, the printer defaults to its normal hammer intensity value.

RIBBON ADVANCE. Relative increment value can be selected from a minimum of 2 to a maximum of 5.

CARRIAGE MOTION. Not programmable within this mode. Derived from the defined value for character spacing as determined by the setting of the PITCH switch, or by the DEFINE HORIZONTAL SPACING INCREMENTS commands.

PRINTWHEEL POSITION. As determined by the ASCII code.

To implement this mode the following example shows the use of a hammer intensity of 4 and a ribbon advance of 4:

Enter the Program mode by transmitting the ESC SO command.
Enter the Secondary Program mode by transmitting the ESC # command.
Send the ASCII code for the character to be printed.
Refer to Appendix C. A hammer intensity of 4 and a ribbon advance of 4 gives a special ASCII character of "K", "L", or "M".
Send one of the special programming characters ("K", "L", "M").

This command terminates the Right Margin Control mode. (5,9)

PROGRAM MODE CARRIAGE MOTION: US d for right movement 1FH/31

This command is only used when the printer is in one of the Program modes. This command causes the carriage to move either left or right between 1/120" and 63/120". d is the distance in 1/120 inch for RIGHT movement; for movement to the left, d is the distance to be moved plus 64 (decimal).

As an example, for a carriage move command of 12/120 inch to the RIGHT, the Basic command is

```
LPRINT CHR$(31);CHR$(12);
```

For a movement of 12/120 inch to the LEFT, the Basic command is

```
LPRINT CHR$(31);CHR$(76);
```

(5,9)

RETURN TO NORMAL MODE: ESC SI 1BH,0FH/27,15

This command terminates the SHIFT TO PROGRAM MODE, ENTER SECONDARY PROGRAM MODE, and USER TEST MODE. (5,9)

TWINTELLECT/DOWNLOAD COMMANDS

The download capability is a function unique to the Qume Connection and to the Qume SPRINT 11 PLUS series of printers.

All printwheels of one type (e.g., WP) have their alphanumeric characters arranged in the same sequence so that the printer knows where to find the character on the printwheel, how hard to fire the hammer, how far to move the ribbon, and in the case of WPS printwheels, how far to move the carriage. This information is in an internal table in the printer's Read Only Memory (ROM).

Some printwheels (e.g., non-English language characters) have a nonstandard sequence of characters and the printer must be programmed to know printwheel spoke position, ribbon advance, hammer force, and character width for these special printwheels. Examples of special sequence printwheels are Deutschland WP and Deutschland WPS. The capability for the Qume printer to use nonstandard sequence printwheels is called Twintellect, and this function may be selected by a printer DIP switch.

Because there are too many different sequences to practically store in the printer's memory, special commands allow the printer to accept and store (for as long as the printer power is turned on) a table of information for a special sequence printwheel. The table may be modified, enabled, or disabled by commands from the computer.

Normally, the printer is operated with Twintellect not selected (off). When Twintellect is selected on power-up, or if there is an error in downloading, the Deutschland WP or WPS table will be loaded by default, depending on the position of the DIP switch.

There are three TWINTELLECT/DOWNLOAD commands: (1) Enable the use of the Twintellect table, (2) Disable the use of the Twintellect table, and (3) Load or Modify the Twintellect table. These commands are discussed in greater detail in the paragraphs that follow.

ENABLE TWINTELLECT DOWNLOAD TABLE: ESC a e 1BH,61H,65H/27,97,101
DISABLE TWINTELLECT DOWNLOAD TABLE: ESC a d 1BH,61H,64H/27,97,100

These commands select or turn off the Twintellect function, overriding the printer switches. A table that has been downloaded can be accessed and used only after the **ESC a e** command has been received. If no table has been downloaded, this command will enable a default table (WPS if Twintellect is OFF, Deutschland WPS if Twintellect is ON). This default table from ROM is automatically placed into the download RAM table when the printer is powered up. Please note that while this will access all of the WPS printwheel information, it will not turn on the carriage proportional spacing algorithm; consequently, all printout will be in monospace. The printer's configuration switches must always be set to correspond to the pitch requirements of the installed printwheel.

The DISABLE command disables, but does not destroy, the download table.

DOWNLOAD OR MODIFY A TWINTELLECT TABLE: ESC a <data> 1BH,61H,3C...,3EH/
27,97,60...,62

This command allows a whole or partial table to be downloaded to the printer. For each printwheel character a field of five elements of information (ASCII character code, printwheel spoke position, ribbon advance, hammer intensity, and character width) is required. To download a table, a user would use the following sequence of information:

```
          1   2   3   4   5     1   2   3   4   5
ESC a <ASCII POS RIB HAM WID, ASCII POS RIB HAM WID,....:CHKSUM >
```

An ASCII comma is used to separate each field. The space shown between elements in a field is not required. The table of values in the printer corresponds to the five pieces of information for each character on the printwheel. The download format is best explained with an illustration.

Assume that for character code 42 hex the printwheel spoke location is 14 hex, the ribbon advance is 5, the hammer intensity is 4, and character width 7. (These values would be obtained from tables available from your local Qume Supplies Distributor.) The checksum calculated for all the values is OBF hex. You would then send the printer the DOWNLOAD command followed by ASCII **42145407,** (the ASCII comma is sent after each group of five; character width requires a leading zero be sent). In Basic, the command is:

LPRINT CHR$(27);"a<42145407,"; next sequence of five and **":BF>";**

where BF is the hex value of the checksum. Notice that the colon is sent instead of a comma after the final group of five values. When all the items in the table are entered an optional : **<checksum>** may be added to validate the data in the download operation. The checksum is calculated by taking the Exclusive Or of each ASCII character after the "<" up to and including the byte before the ":". Commas are included in the checksum calculation. Although legal values for character width cannot exceed OFH, two bytes are always required. The additional byte is reserved for future applications. Similarly, some ribbon advance and hammer intensity parameters are reserved for future use. Table 3 below shows the legal hex values which may be loaded into the Twintellect table.

Table 3. Size and Value Parameters for Twintellect Table

ELEMENT	BYTES REQUIRED	LEGAL VALUES (HEX)
ASCII Code	2	20 to 7F
Printwheel Spoke Position	2	00 to BE
Ribbon Advance	1	3 to 7
Hammer Intensity	1	1 to 6
Character Width	2	00 to 0F

Values for any printwheel character are easily modified without changing the entire table. Simply enter the modified values into a download command. Note that all five elements of the field must be included (eight bytes plus a comma). The ASCII character code will ensure that the new values are correctly located within the table.

Twintellect Download Error Conditions

If an error is identified during a download operation, the loading sequence is aborted at the location in the table where the error occurred. A default table (WPS if the Twintellect DIP switch is OFF, Deutschland WPS if Twintellect is ON) is then loaded to replace the current table. After the download sequence is aborted, the remainder of the table is printed out.

Download errors may be caused by any of the four following conditions:

1. A communication error occurred during the download operation.

2. A field does not contain exactly five elements (nine bytes including the comma separator).

3. One or more elements have a value outside the specified value range (the character is not 0-9 or A-F ASCII).

4. A checksum error occurred (when the checksum option is used).

PRINTER COMMANDS

BELL (AUDIBLE ALARM): BEL 07H,7

Receipt of this command will cause the printer to sound its audible alarm. (5,9,D)

FORCE EXECUTION: ESC x, X 1BH,78H/27,120

These commands execute all accumulated motions completely before the next data can be processed. Motions accumulate in the buffer as a result of the printer's motion minimization feature. The printer's internal control program uses motion minimization to provide maximum speed. When horizontal or vertical motion commands (other than FORM FEED) are removed from the receive buffer, a sequence of them will be executed as a single motion. For example, seven SPACE commands (in 10 pitch) would result in a single carriage motion of 0.7 inches; a SPACE command followed by a BACKSPACE command would result in NO horizontal motion; six LINE FEED commands would result in a single paper motion of one inch.

INITIALIZE PRINTER (RESTORE): ESC SUB I or 1BH,1AH,49H/27,26,73 or
ESC CR P 1BH,0DH,50H/27,13,80
DELETE (switch selected) 7FH/127

All of these commands initialize (reset) the printer. ESC SUB I, however, does not clear out the buffer. ESC CR P does clear out the buffer. If the INHIBIT DELETE DIP switch is OFF, the printer will accept the DELETE cosde as an initialization command but will reset only the printing parameters. The Twintellect table, if downloaded, will not be changed by any of these commands.

All three commands cause the printer to read all of the DIP switches and the set the following parameters:

- The carriage is moved to column 0.
- The printwheel is synchronized with the printer's electronics.
- The right margin is set at the right most column (right side frame).
- The left margin is set at column 0.
- All tab stops are cleared.
- The top margin is set at the top of form position.
- The bottom margin is set at the position defined by the form length switch.
- Both Graphics modes OFF.
- Forward Print mode ON.
- Both Program modes OFF.
- Right Margin Control mode OFF
- Underscore, Bold Overprint, Shadow Print, and No Print modes OFF.
- User Test mode OFF.

SHEET FEEDER COMMANDS

These commands control the Single Bin Sheet Feeder, which is an accessory. The SPRINT 11 PLUS user should be aware that all the intelligence required to drive the Single Bin Sheet Feeder from a host system is provided by the Qume Connection interface module attached to the SPRINT 11 PLUS printer.(The Sprint 3 Model I module is an Exception; SPRINT 11 PLUS printers equipped with this interface module must drive the Single Bin Sheetfeeder from the host system.) The "FORM FEED" command, contained in ROM in the inteface module, initiates the process which drives the Sheetfeeder from a host system. Once the program is initialized, driver functions are performed in the following sequence:

1. **Paper is moved from the paper hopper to paper loading position.**
2. **Paper is moved to the desired print position.**
3. **Paper is ejected to the sheetfeeder paper stacker as each print operation is completed.**

When the FORM FEED command is used in this fashion, the commands listed below need not be used.

SHEET INSERT FROM TRAY ONE: ESC i 1BH,69H/27,105

This command instructs the printer to insert a sheet of paper from tray one of the Cut Sheet Feeder. As a platen driven, mechanical device, the Cut Sheet Feeder is only operational when the printer receives the appropriate commands from the computer. If the Cut Sheet Feeder is not installed, an **ESC i** command will be ignored by the printer.

SHEET EJECT: ESC j 1BH,6AH/27,106

This command instructs the printer to eject a sheet of paper to the collection bin of the Cut Sheet Feeder.

TEST COMMANDS

TERMINAL SELF TEST: ESC SUB SO 1BH,1AH,0EH/27,26,14

The Terminal Self Test routine is a comprehensive test of the printer's mechanical and electronic functions. Once the Self Test routine is initiated, all further commands will be ignored until the test is completed. (5,9)

USER TEST MODE COMMANDS

ENTER USER TEST MODE: ESC @ T 1BH,40H,54H/27,64,84

The User Test mode allows the host computer to program the printer to perform a test program of any length up to a maximum of 500 characters.

To utilize the user test mode:

1. The computer sends **ESC @ T.** (5,9)
2. Up to 500 characters are entered into the printer buffer.
3. The computer sends an **EOT** when the program is entered. (5,9)
4. To run the test one time, send **STX** (PERFORM USER TEST ONCE). (5,9,D)
5. To run a continuous test, send **SOH** (PERFORM USER TEST CONTINUOUSLY). (5,9,D)
6. To halt the continuous test, send **ENQ** (HALT CONTINUOUS USER TEST). (5,9)
7. To leave the User Test Mode and erase it, send **ESC SI** (RETURN TO NORMAL MODE).

SPECIAL CHARACTER PRINTING

PRINT CHARACTER AT PRINTWHEEL POSITION 004:	**ESC SP**	1BH,20H/27,32
PRINT CHARACTER AT PRINTWHEEL POSITION 002:	**ESC /**	1 BH,2FH/27,47

There are two positions on all printwheels which do not correspond to a single standard ASCII character code. The reason for this is that of the 96 ASCII codes from 20 hex to 7F hex, two are special: SPACE and DELETE. SPACE is really a motion command and DELETE may have special functions, including resetting the printer. These special characters, though not necessarily the same for all printwheels, usually are:

- or = located at position 002

¢ or | located at position 004.

APPENDIX A
ASCII CODE CHART

Bits b_7 b_6 b_5					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_4	b_3	b_2	b_1	Row ↓ Column →	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
1	0	1	1	B	VT	ESC	+	;	K	[	k	{
1	1	0	0	C	FF	FS	,	<	L	\	l	|
1	1	0	1	D	CR	GS	-	=	M	]	m	}
1	1	1	0	E	SO	RS	.	>	N	^	n	~
1	1	1	1	F	SI	US	/	?	O	-	o	DEL

HEXADECIMAL = ASCII COLUMN + ROW

APPENDIX B
SAMPLE BASIC FORMATTING PROGRAM

```
LIST
 10 REM SAMPLE PROGRAM TO SET MARGINS
 20 REM
 30 REM  TOP, LEFT, RIGHT, TEXT LENGTH
 40 REM
 50 TM=6: REM  TOP MARGIN, LINES DOWN FROM TOP OF FORM
 60 TL=54: REM  NUMBER OF TEXT LINES ON PAGE
 70 LM=10: REM  LEFT MARGIN, NUMBER OF SPACES
 80 RM=72: REM  RIGHT MARGIN, NUMBER OF CHARACTERS PER LINE
 90 REM  RIGHT MARGIN = CHARACTERS/LINE + LEFT MARGIN SPACES
100 REM
110 REM
120 REM  SET LEFT AND TOP MARGINS:
130 REM
140 FOR I=1 TO TM
150 LPRINT
160 NEXT I
170 REM
180 FOR I=1 TO LM
190 LPRINT " ";
200 NEXT I
210 LPRINT CHR$(27); "+";: REM  SET TOP MARGIN
220 LPRINT CHR$(27); "9";: REM  SET LEFT MARGIN
230 FOR I=1 TO RM
240 LPRINT " ";
250 NEXT I
260 LPRINT CHR$(27);"O": REM  SET RIGHT MARGIN
270 REM
280 FOR I=1 TO TL: REM  TEXT LENGTH, NUMBER OF LINES
290 LPRINT
300 NEXT I
310 LPRINT CHR$(27);"-": REM  SET BOTTOM MARGIN
OK
```

APPENDIX C

PROGRAM MODE "SPECIAL CHARACTER"

CARRIAGE	HAMMER 0	1	2	3	4	5	6	7	RIBBON INCREMENT VALUE
0	NUL	DLE	SP	0	@	P	`	p	2
1	SOH	DC1	!	1	A	Q	a	q	
2	STX	DC2	"	2	B	R	b	r	
3	ETX	DC3	#	3	C	S	c	s	
4	EOT	DC4	$	4	D	T	d	t	
5	ENQ	NAK	%	5	E	U	e	u	
6	ACK	SYN	&	6	F	V	f	v	
7	BEL	ETB	'	7	G	W	g	w	3
8	BS	CAN	(	8	H	X	h	x	
9	HT	EM	)	9	I	Y	i	y	
10	LF	SUB	*	:	J	Z	j	z	
11	VT	ESC	+	;	K	[	k	{	4
12	FF	FS	,	<	L	\	l	|	
13	CR	GS	-	=	M	]	m	}	
14	SO	RS	.	>	N	^	n	~	5
15	SI	US	/	?	O	-	o	DEL	

Carriage motion is in increments of 1/120".
Zero hammer intensity causes default to normal intensities.
Ribbon feed is a carriage motion function of the Program Mode and is not independently selectable except during the Secondary Program Mode.
Shaded areas show illegal commands.

APPENDIX D
DECIMAL - HEX - ASCII CONVERSION CHART

CONTROL CODES			NUMBERS, SYMBOLS			UPPER CASE			LOWER CASE		
DEC	HEX	ASCII	DEC	HEX	ASCII	DEC	HEX	ASCII	DEC	HEX	ASCII
0	0	NUL	32	20	SP	64	40	@	96	60	`
1	1	SOH	33	21	!	65	41	A	97	61	a
2	2	STX	34	22	"	66	42	B	98	62	b
3	3	ETX	35	23	#	67	43	C	99	63	c
4	4	EOT	36	24	$	68	44	D	100	64	d
5	5	ENQ	37	25	%	69	45	E	101	65	e
6	6	ACK	38	26	&	70	46	F	102	66	f
7	7	BEL	39	27	'	71	47	G	103	67	g
8	8	BS	40	28	(	72	48	H	104	68	h
9	9	HT	41	29	)	73	49	I	105	69	i
10	A	LF	42	2A	*	74	4A	J	106	6A	j
11	B	VT	43	2B	+	75	4B	K	107	6B	k
12	C	FF	44	2C	,	76	4C	L	108	6C	l
13	D	CR	45	2D	-	77	4D	M	109	6D	m
14	E	SO	46	2E	.	78	4E	N	110	6E	n
15	F	SI	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	48	30	0	80	50	P	112	70	p
17	11	DC1	49	31	1	81	51	Q	113	71	q
18	12	DC2	50	32	2	82	52	R	114	72	r
19	13	DC3	51	33	3	83	53	S	115	73	s
20	14	DC4	52	34	4	84	54	T	116	74	t
21	15	NAK	53	35	5	85	55	U	117	75	u
22	16	SYN	54	36	6	86	56	V	118	76	v
23	17	ETB	55	37	7	87	57	W	119	77	w
24	18	CAN	56	38	8	88	58	X	120	78	x
25	19	EM	57	39	9	89	59	Y	121	79	y
26	1A	SUB	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	59	3B	;	91	5B	[	123	7B	§
28	1C	FS	60	3C	<	92	5C	®	124	7C	¶
29	1D	GS	61	3D	=	93	5D	]	125	7D	†
30	1E	RS	62	3E	>	94	5E	©	126	7E	~
31	1F	US	63	3F	?	95	5F		127	7F	DEL

APPENDIX E
COMMAND SET SUMMARY

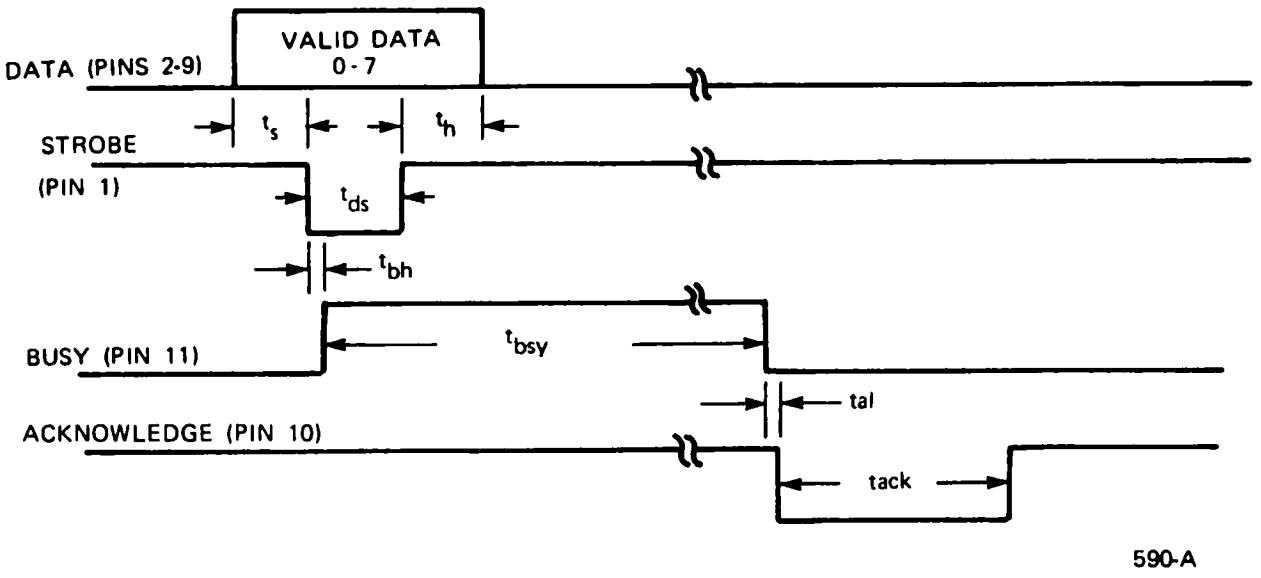
	ASCII	HEX	DECIMAL
MARGIN COMMANDS			
Set Top Margin:	ESC +	1B,2B	27,43
Set Bottom Margin:	ESC -	1B,2D	27,45
Set Left Margin:	ESC 9	1B,39	27,57
Set Right Margin:	ESC 0	1B,30	27,48
Right Margin Control On:	ESC O	1B,4F	27,79
Right Margin Control Off:	ESC Y	1B,59	27,89
LINESPACING (VERTICAL) COMMANDS			
Define Vertical Spacing Increments:	ESC L d1 d2	1B,4C	27,76
Alt. Define Vert. Spacing Increments: (distance + 1)	ESC RS	1B,1E	27,30
Set Form Length:	ESC F d1 d2	1B,46	27,70
Auto Carriage Return/Line Feed On:	ESC W	1B,57	27,87
Auto Carriage Return/Line Feed Off:	ESC Z	1B,5A	27,90
Auto Line Feed On:	ESC comma	1B,2C	27,44
Auto Line Feed Off:	ESC period	1B,2E	27,46
CHARACTER SPACING (HORIZONTAL) COMMANDS			
Define Horizontal Space Increments:	ESC E d1 d2	1B,45	27,69
Define Horizontal Space Increments Alt.:	ESC US(dis+1)	1B,1F	27,31
WPS On:	ESC $	1B,24	27,36
WPS Off:	ESC %	1B,25	27,37
TAB COMMANDS			
Set Horizontal Tab Stop:	ESC 1	1B,31	27,49
Clear Horizontal Tab Stop:	ESC 8	1B,38	27,56
Clear All Horizontal Tab Stops:	ESC 2	1B,32	27,50
Set Tab List:	ESC (list	1B,28	27,40
Clear Tab List:	ESC) list	1B,29	27,41
PAPER MOVEMENT (VERT. MOTION) COMMANDS			
Line Feed:	LF	0A	10
Negative Line Feed:	ESC LF	1B,0A	27,10
Half Line Feed:	ESC U	1B,55	27,85
Negative Half Line Feed:	ESC D	1B,44	27,68
Auto Carriage Return/Line Feed On:	ESC W	1B,57	27,87
Auto Carriage Return/Line Feed Off:	ESC Z	1B,5A	27,90
Absolute Vertical Tab to a Line Number:	ESC P d1 d2	1B,50	27,80
Absolute Vertical Tab to a Line Number ALT.:	ESC VT (dis+1)	1B,0B	27,11
Relative Vertical (Paper Feed) Motion:	ESC V n1 n2 n3	1B,56	27,86
Form Feed:	FF	0C	12
CARRIAGE MOVEMENT (HOR. MOTION) COMMANDS			
Horizontal Tab:	HT	09	9
Absolute Horiz. Tab to a Column Number:	ESC C d1 d2	1B,43	27,67
Absolute Horiz. Tab to a Column Number Alternate):	ESC HT (dis+1)	1B,09	27,9
Relative Horizontal Motion:	ESC H n1 n2 n3	1B,48	27,72
Backward Print:	ESC 6	1B,36	27,54
Forward Print:	ESC 5	1B,35	27,53
Auto Bidirectional Printing On:	ESC <	1B,3C	27,60

	ASCII	HEX	DECIMAL
Auto Bidirectional Printing Off:	ESC >	1B,3E	27,62
Space:	SP	20	32
Backspace:	BS	08	8
Backspace 1/120":	ESC BS	1B,08	27,8
Carriage Return:	CR	0D	13
PRINTING COMMANDS			
Underscore On:	ESC I	1B,49	27,73
Underscore Off:	ESC J	1B,4A	27,74
Bold Overprint On:	ESC K d	1B,4B	27,75
Bold Overprint Off:	ESC M d	1B,4D	27,77
Shadow Print On:	ESC Q	1B,51	27,81
Shadow Print Off:	ESC R	1B,52	27,82
No Print On:	ESC S	1B,53	27,83
No Print Off:	ESC T	1B,54	27,84
GRAPHICS COMMANDS			
Graphics On 1/60":	ESC 3	1B,33	27,51
Graphics On 1/120":	ESC G	1B,47	27,71
Graphics Off (all):	ESC 4	1B,04	27,4
No Carriage Movement on Next Character:	ESC N	1B,4E	27,78
PRINTER PROGRAM MODES			
Shift to Program Mode:	ESC SO	1B,0E	27,14
Enter Secondary Mode:	ESC #	1B,23	27,35
Program Mode Carriage Motion:	US d	1F	31
Return to Normal Mode:	ESC SI	1B,0F	27,15
Enable Twintellect Download Table:	ESC a e	1B,61,65	27,97,101
Disable Twintellect Download Table:	ESC a d	1B,61,64	27,97,100
Download or Modify Twintellect Table:	ESC a (data)	1B,61,3C	27,97,60...62
PRINTER COMMANDS			
Bell:	BEL	07	7
Force Execution:	ESC x or ESC X	1B,78	27,120
Initialize Printer (Restore):	ESC SUB I or	1B,1A,49	27,63,73
	ESC CR P	1B,0D,50	27,13,80
SHEET FEEDER COMMANDS			
Sheet Insert From Tray One:	ESC i	1B,69	27,105
Sheet Eject:	ESC e	1B,65	27,101
TEST COMMANDS			
Terminal Self-Test:	ESC SUB SO	1B,1A,0E	27,26,14
Enter User Test Mode:	ESC @ T	1B,40,54	27,64,84
Perform User Test Once:	STX	02/2	
Perform User Test Continuously:	SOH	01/1	
Halt Continuous User Test:	ENQ	05/5	
Return to Normal Mode:	ESC	1B/27	
SPECIAL CHARACTER PRINTING			
Print Position 004:	ESC SP	1B,20	27,32
Print Position 002:	ESC /	1B,2F	27,47

APPENDIX F
INTERFACE SIGNAL TIMING

The following timing diagram represents the various interface signals used by the QUME CONNECTION. These are important if you are designing your own interface circuit. Otherwise, they are the same as is used on most Centronics interfaces.

The QUME CONNECTION uses 7417 open collector drivers for output signals. These signals must be pulled up externally. Most computer systems with Centronics-type interfaces do this. QUME CONNECTION signal inputs use standard TTL receivers with pull-up resistors.



TIMING PARAMETERS - QUME CONNECTION IBM CENTRONICS INTERFACE

SIGNAL		MINIMUM	MAXIMUM
t_s -	Setup time	0.5 usec	-
t_h -	Hold time	0.5 usec	-
t_{ds} -	Data strobe length	0.5 usec	500 usec
t_{bh} -	Delay to busy high		<0.1 usec
t_{bsy} -	Busy length	0.1 usec	10 seconds
t_{al} -	Delay to acknowledge low		<0.1 usec
t_{ack} -	Acknowledge pulse length	2.5 usec	5.0 usec (5.0 usec

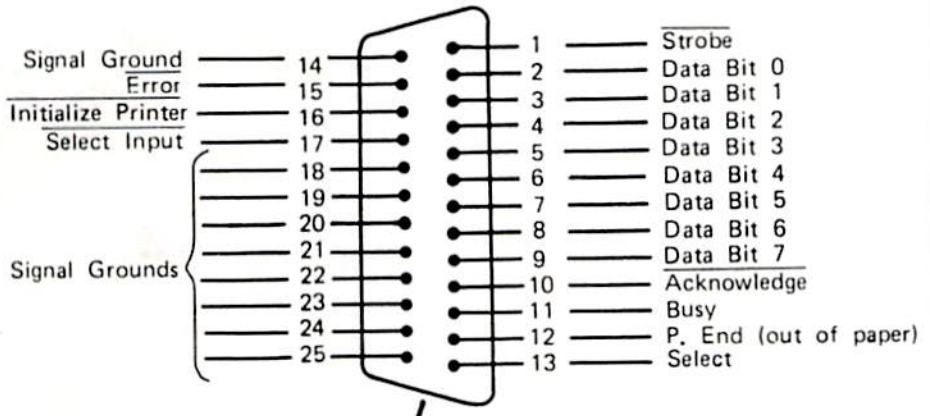
APPENDIX G
INTERFACE CONNECTOR AND SIGNALS

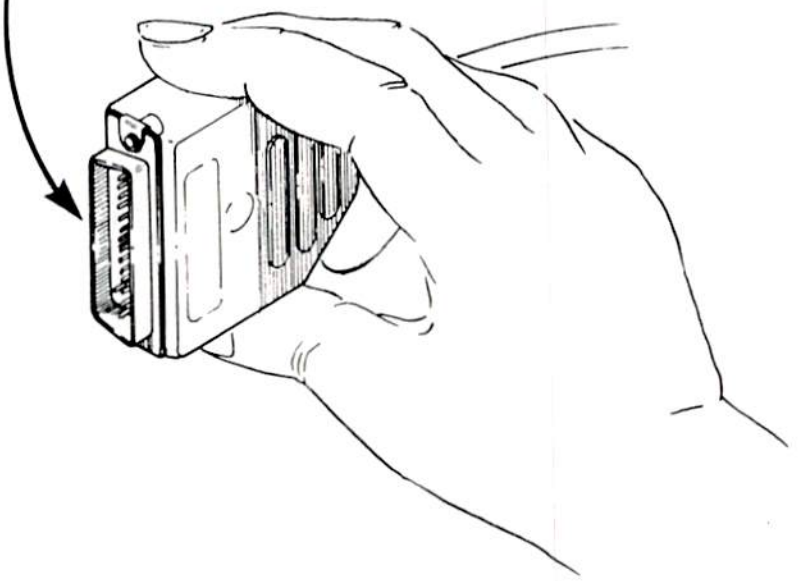
The following table lists the interface signals and decribes their function. Logic 1 is high (i.e., 2.4 to 5.0 Vdc). Logic 0 is low (i.e., 0.0 to 0.4 Vdc). The assigned signals are the same as those that appear on generic Centronics-type interfaces. The standard Centronics connector, however, accomodates 36 pins whereas the IBM PC parallel printer adapter card is equipped with a 25 pin "D" shell connector. Pinouts from the QUME CONNECTION connector are specifically designed to match the requirements of the IBM PC (see the illustration on the next page).

Pin Number	Signal	Description
1	$\overline{\text{STROBE}}$	Input to printer. A strobe pulse latches data into the printer. Pulse width: from 1.0 to 500 microseconds. May be either active high or low, switch selectable. Strobe must be sent 1.0 1.0 microsecond (min.) after valid data.
2	DATA 0	Input data to printer.
3	DATA 1	Data 8 = LSB (Least Significant Bit)
4	DATA 2	Data 1 = MSB (Most Significant Bit).
5	DATA 3	ASCII codes normally use Data 1-7.
6	DATA 4	Data 8 not used. Logic 1 high (2.4-5.0 Vdc).
7	DATA 5	Logic 0 low (0 to 0.4 Vdc).
8	DATA 6	
9	DATA 7	
10	$\overline{\text{Acknowledge}}$	Output from printer. A low pulse (5 microseconds) indicates the printer has accepted the input data.
11	BUSY	Output from printer. Printer sets this line high to indicate printer is busy; low indicates printer is not busy and can accept data. A Busy is sent after each character received.
12	P. End (out of paper)	Output from printer. High indicates out of paper. (Stop Print On Paper Out switch on printer does not affect this signal.)
13	Select	Output from printer. High indicates printer is selected and ready to receive data.
14		Signal Ground.
15	$\overline{\text{Error}}$	Output from printer. A low indicates printer needs attention: Ribbon out, cover off, or printer in CHECK.

Pin Number	Signal	Description
16	$\overline{\text{Initialize Printer}}$	Input to printer. A low pulse (1.0 microsecond minimum) initializes the printer. Clears printer input buffer and sets the printer to default parameters. Performs a Restore function.
17	$\overline{\text{Select Input}}$	Input to printer. This signal must be low before the printer will accept data.

Signal Grounds - Pins 18 to 25





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ESC BS command....29
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ESC e command....40
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ESC N command....32
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THE QUME CONNECTION IBM PC Centronics Interface
Reorder Number 32115, August 1983

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The QUME CONNECTION RS-232-C Model 1 Interface

November 1983

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PREFACE

This manual describes the installation and operation of the Qume Connection RS-232-C module. The RS-232-C module is one of a series of Qume Connection modules designed to interface Qume printers to a wide variety of computer systems. The module easily plugs into the 50-pin edge-board connector mounted on the back of your Qume printer. Once these connections are made and the DIP (Dual Inline Pack) switches on the printer and on the Qume Connection are correctly set, your computer can communicate with the Qume printer.

The first section of this manual, **INSTALLING THE QUME CONNECTION**, tells how to install and test the Qume Connection and how to make the hardware connection between the Qume printer and your computer system. This section also provides some background information on serial interface connections that should prove helpful when setting the printer and Qume Connection DIP switches.

The second section, **COMPUTER - PRINTER OPERATION**, addresses the most basic of user concerns: moving characters from your computer to the printer and ultimately onto paper.

The third section, **PROGRAMMING THE QUME CONNECTION**, describes in detail how the Qume Connection program commands work.

The last section of the manual, **COMMAND SET**, provides a detailed explanation of each of the Qume Connection program commands. Not everyone, of course, needs to understand these commands in a detailed fashion. If you only intend to use your Qume printer to print documents that you have created with a canned word processing program (e.g., Wordstar™), you may never need to worry about the program commands. They will have already been incorporated in your word processing software. Even so, you may still want to review the Qume Connection command set to determine how effectively your particular software driver uses the intelligence present in the Qume printer.

The QUME CONNECTION module is designed for use with a variety of Qume printer products. Consequently, this manual makes no attempt to describe the operation of your Qume printer. Refer to the following publications for questions related to the operation or maintenance of your printer:

Publication	Reorder Number
SPRINT 11 PLUS Operator Manual	32026
SPRINT 11 PLUS Field Maintenance Manual	32077
Supplies Catalog	38012
Printers and Accessories Catalog	33032

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INSTALLATION AND TESTING

Instructions for unpacking the Qume printer are provided with the printer. Following these instructions, carefully unpack the printer and, if you haven't already unpacked it, the QUME CONNECTION RS-232-C module.

Make sure the AC power to the printer is turned off. Then install The QUME CONNECTION RS-232-C on the printer. The QUME CONNECTION module easily plugs into the rear of the printer, as illustrated in Figure 1.

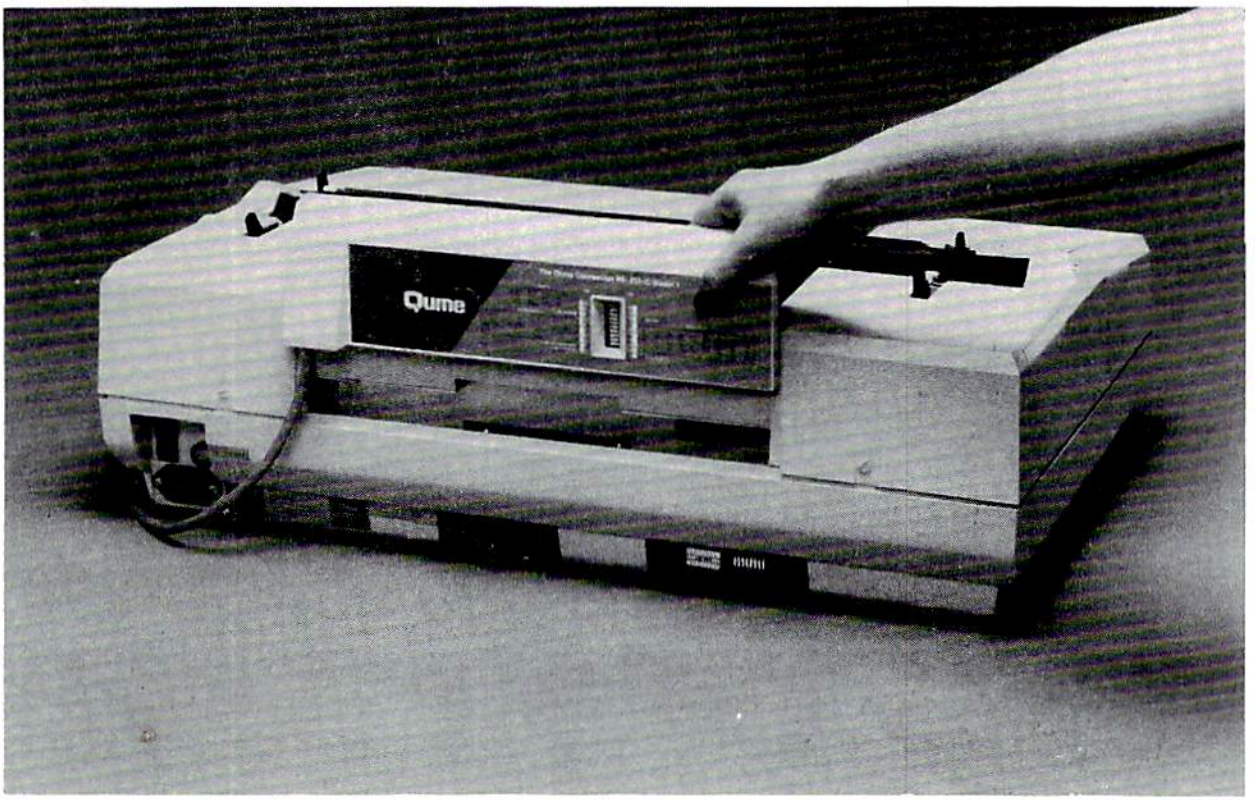

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Figure 1. Installing the QUME CONNECTION - RS-232-C

Before hooking the QUME CONNECTION connector to your computer, test the Qume printer by running the printer's internal Self-Test routine.

RUNNING THE SELF-TEST

Your Qume printer includes an internal diagnostic routine (Printer Self-Test) which tests the printer's basic electronic and mechanical functions. This routine is easily initiated via the front panel Form Feed switch. The QUME CONNECTION also provides a Self-Test (Terminal Self-Test) routine that tests the QUME CONNECTION circuitry in addition to verifying the electronic and mechanical functions of the printer. The existence of two Self-Test procedures greatly simplifies troubleshooting procedures. If the Printer

Self-Test executes but the Terminal Self-Test does not, there is probably a problem in the interface module. If neither Self-Test works, the problem is most likely in the printer and not in the QUME CONNECTION module.

Before running either of these Self-Tests, ensure that there is a good ribbon, a printwheel, and paper installed in the printer. (The paper should be at least 12 inches wide.) A WP printwheel must also be installed to run the Printer Self-Test. A WP or WPS printwheel can be used for the Terminal Self-Test. Then turn off the power to the printer and proceed as follows:

Printer Self-Test

The Printer Self-Test is executed by the printer's master microcomputer and exercises the printing mechanism and supporting electronics in your Qume printer. To initiate Printer Self Test, turn on the power to the printer while pressing the Form Feed switch. The Qume printer will perform an initialization sequence (you will see the carriage move to the left) and then will begin continuously printing lines of all of the characters on the printwheel in a "barber pole" swirl. Note that the barber pole printing will always be in 10 pitch. Once the printer begins printing, you can release the Form Feed switch. Figure 2 illustrates part of a typical barber pole printout.

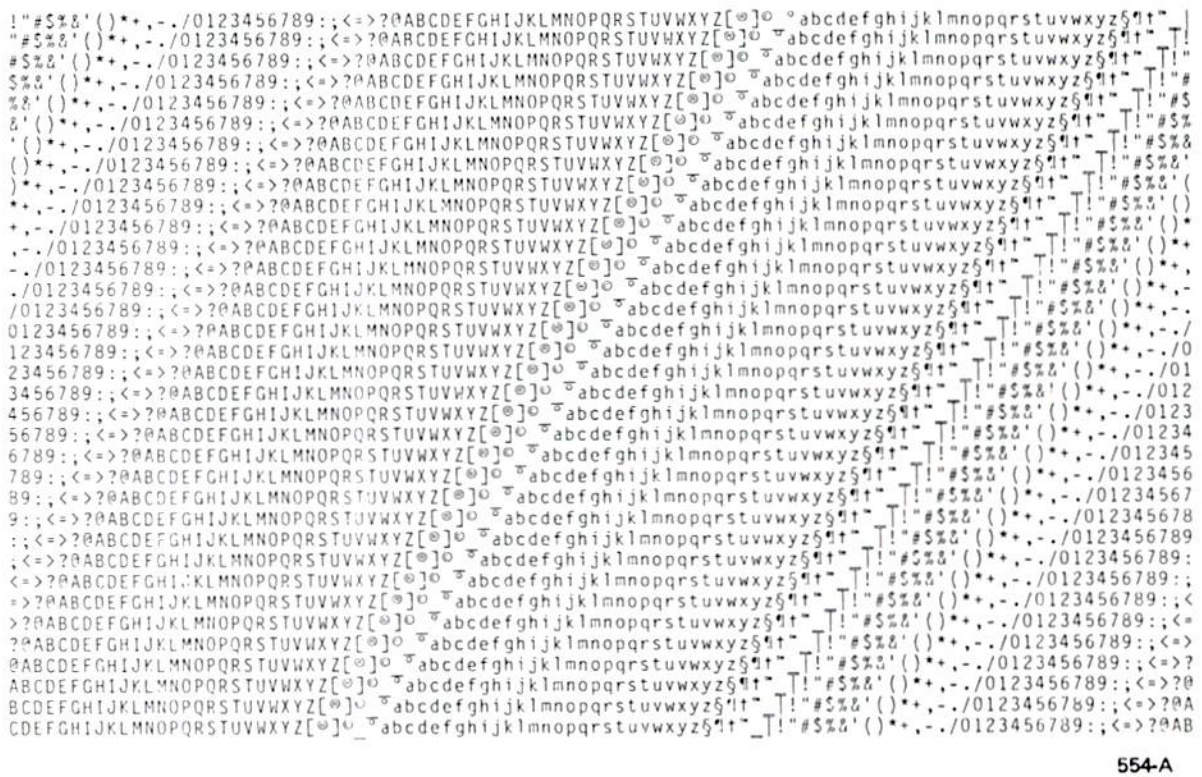


Figure 2. "Barber Pole" Printout from Printer Self-Test

The printer will continue printing until power is turned off or until the Form Feed switch is pressed and held as the printer completes a line of characters.

Terminal Self-Test

The Terminal Self-Test is a more extensive diagnostic test than the Printer Self-Test. Terminal Self-Test is executed entirely by the QUME CONNECTION's control microcomputer. Not only are the printing mechanisms exercised, but the terminal microcomputer and supporting circuits are also tested. Hence, successful completion of Terminal Self-Test indicates that both the printer and the QUME CONNECTION are functioning properly.

You can initiate a Terminal Self-Test by pressing and holding the Pause switch while the power to the printer is turned on. Once the Self-Test begins, release the switch. The printer will first print the software version number, the current DIP switch settings, the current options selected, the success or failure of the internal loop back test, the success or failure of the external loop back test (printed only if the special external loop back test connector is installed), and finally lines of all the characters on the printwheel (see Figure 3). The character printout will continue until the power is turned off or until the PAUSE switch is pressed twice. When the printout is ended, the QUME CONNECTION sends a status indicator, represented by a single ASCII character, out through the USART. If the external loop back test connector is installed, this character will be printed by the printer. See the STATUS REQUEST/STATUS REPLY commands for additional details.

```
Software Version  1.6


MODULE DIP Switch: 0101100011      MAIN BOARD DIP Switch: XXIIIIII      FRONT PANEL DIP Switch A: IIII   Switch B: IIII
0: ON      1: OFF      X: DON'T CARE
Parity: MARK
Modem: NO
Handshake: ETX/ACK
Baud rate: 9600
Stop print on paper out: OFF
Duplex: FULL
AUTO CR/LF: OFF
Bidirectional printing: OFF
Twintellect: OFF
Lines per inch: 6
AUTO LF: OFF
Form length: 3"
Character spacing: 10


Internal loop back test PASSED


c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~-
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~-
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~-
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~-
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~-
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~-
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~-
c!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~-
```

Figure 3. Character Printout from Terminal Self-Test

Note that the binary representation of the module and main board DIP switches begins with the highest switch (e.g., switch 10 on the module DIP switch; switch 8, "X", on the main board DIP switch) and ends with the lowest (switch 1). The printout for front panel DIP switches A and B begins with switch 1 and ends with switch 4.

Once you have successfully executed both Self-Test routines, hook the QUME CONNECTION serial connector to your computer, and turn to the Setting the DIP Switches section of this manual. For those of you with a technical orientation, the following paragraphs provide additional detail on the Terminal Self-Test.

When the QUME CONNECTION's terminal microcomputer receives a Self-Test command via the PAUSE switch, the terminal microcomputer commands the printer microcomputers to execute an initialization (Restore) sequence.

The terminal microcomputer then tests its Read Only Memory (ROM) with a checksum routine and tests its Random Access Memory (RAM) by writing bit patterns into memory and reading them back. If an error is detected in either ROM or RAM, the terminal's audible alarm will sound continuously and the test will halt.

Following the memory test, the communication loop is tested in two ways:

1. The terminal microcomputer will first test the Universal Synchronous/ Asynchronous Receiver Transmitter (USART) by looping characters from the CPU to the USART and back to the CPU. If an error is found, the terminal will print "Internal Loop Back Test Failed" and ring the buzzer continuously. If no error is discovered, the message "Internal loop back test PASSED" is printed. The terminal microcomputer then sends the characters to the printer microcomputers for printing.

2. In the External Loop Back Test, the terminal microcomputer will send characters from the CPU, through the USART, to the serial data port and back through the USART to the terminal microcomputer, and then back to the printer microcomputers. This additional loop completely checks the terminal interface. Note that a special loop-back connector, available from Qume, must be installed in the serial data connector of the QUME CONNECTION before this test is run. This connector is a DB-25P female connector with the following pins jumpered:

   pin 2 - 3, pin 4 - 5, pin 20 - 6, pin 23 - 8

   After the completion of this test, the printer prints "External loop back test PASSED." Note that if the special connector is installed and no message is printed, the external loop back test has failed.

For future reference, note that once your computer is connected to the Qume printer, the Terminal Self-Test can also be initiated from your computer. Sending **ESC SUB SO** from your computer to the printer will initiate a Terminal Self-Test. A Terminal Self-Test initiated from your computer will, however, end after one line of characters is printed. An additional command, ENTER USER TEST MODE, allows you to program the printer to perform a test program of any length up to a maximum of 500 characters (see COMMAND SET section).

SETTING THE DIP SWITCHES

Before your computer can successfully drive the Qume printer, you must correctly configure four sets of DIP switches: one on the back of the QUME CONNECTION module, two on the back of the printer's front panel, and a fourth on the printer's rear panel. Labels are provided on both the QUME CONNECTION module and on the back of the printer's operator access panel to indicate the function and correct positioning of each switch. If you have never interfaced a printer to a computer before, read the section of this manual devoted to Serial Interfacing. It should quickly lessen the anxiety you may feel about delving into the mysteries of baud rates, handshaking, parity and the like. It may also save you an enormous amount of time and frustration. Quite simply, the printer will not work if the DIP switches are in the wrong position. Remember that whenever you change a DIP switch position, you must turn the printer off and back on before that switch position will be recognized. PITCH, AUTO LF, and 6 or 8 LINES/INCH are the only exceptions to this rule; the printer reads the status of these switches constantly.

QUME CONNECTION DIP Switch Settings

A ten position DIP switch is located on the back of the QUME CONNECTION module. Figure 4 identifies each of the ten switches. An explanation of the function of each switch follows. For further details, read the Serial Communications Interface section of this manual.

HALF DUPLEX
FULL DUPLEX (1)

The FULL DUPLEX mode permits independent simultaneous transmission and reception of data. The HALF DUPLEX mode allows unidirectional (one way) transmission.

STOP PRINT ON PAPER OUT
STOP PRINT ON PAPER OUT OFF (2)

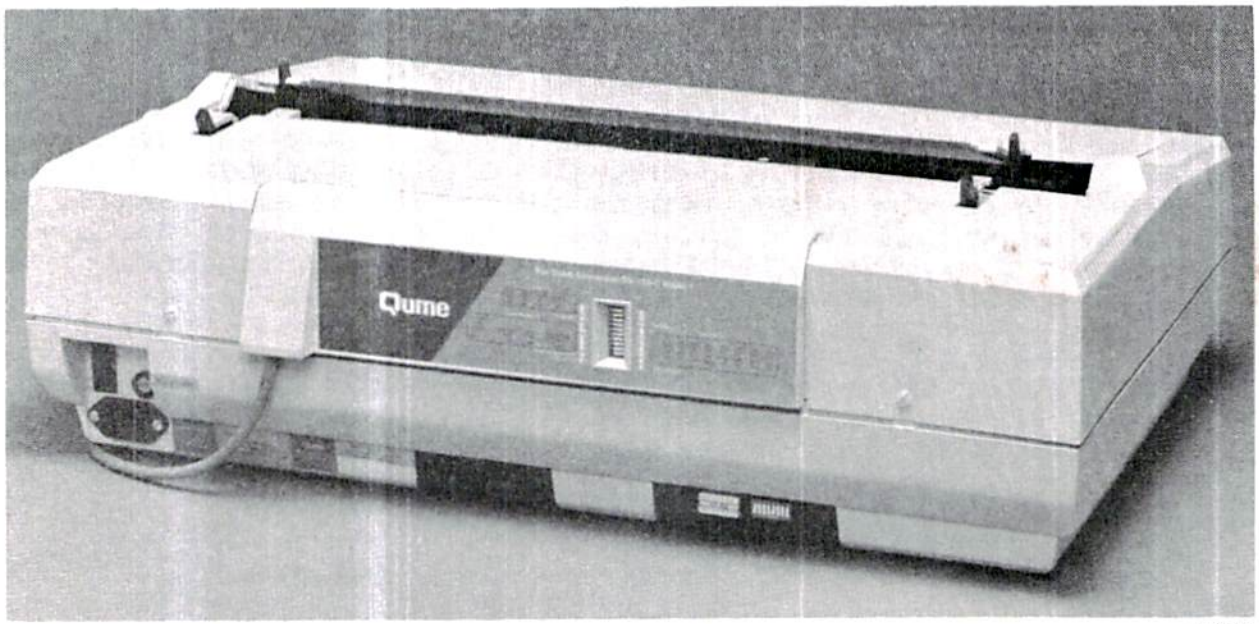
This switch directs the printer to stop or to continue to print when a paper out condition is detected. Note that the switch is only functional when a paper out sensor (located on the Bidirectional Tractor or Mechanical Sheet Feeder) is installed. Regardless of switch position, an audible alarm will sound momentarily when the paper supply runs out

BAUD RATE (3, 4, 5)

These three switches are set to the speed at which data is received and transmitted between the computer and the QUME CONNECTION. A baud rate must be selected which matches the speed at which your computer transmits data. The QUME CONNECTION supports the following switch selectable baud rates: 110, 150, 300, 600, 1200, 2400, 4800, and 9600.

ETX/ACK, XON/XOFF, DTR (6, 7)

These switches control handshaking signals. Handshaking is the method by which communication is coordinated between your computer and the QUME CONNECTION. See the Serial Interface section for details.



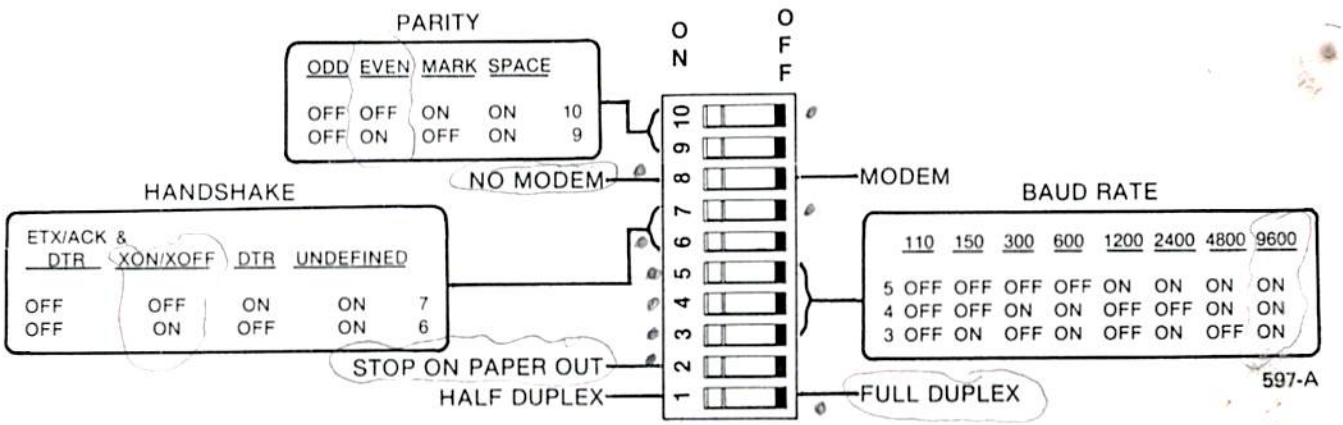


Figure 4. QUME CONNECTION DIP Switch Settings

NO MODEM
MODEM (8)

A modem is a device that converts printer and computer signals for long distance transmission via suitable communications lines. If you have a modem or a similiar device connected to the QUME CONNECTION, position the switch in the MODEM mode. Place the switch in the NO MODEM mode if you have the QUME CONNECTION directly hooked ("hardwired") to your computer. See then SERIAL COMMUNICATIONS INTERFACE discussion for a more detailed discussion.

PARITY (9, 10)

Parity is an error checking method used to detect if bits of data were lost or changed during transmission. Set these switches to correspond with the type of parity used by your computer. When MARK or SPACE parity is selected, the QUME CONNECTION ignores the parity bit when receiving data.

Printer DIP Switch Settings

There is a set of eight position DIP switches located on the back of the printer and two sets of four position DIP switches on the back of the Qume printer's front panel. The switch positions are labeled on the back of the printer's operator access panel and are explained in greater detail in the printer's Operator Manual. Typical functions for these switches are described in the following paragraphs.

TWINTELLECT GERMAN WP

The TWINTELLECT GERMAN WP switch allows printwheels with special German character sequences to be used. When using standard WP and WPS type printwheels, place the switch in the OFF position. Select Twintellect only if you are using a Deutschland WP or Deutschland WPS printwheel. Note that the Deutschland WPS printwheel also requires that you place the pitch DIP switches in WPS mode.

AUTO BIDIRECTIONAL PRINTING
AUTO BIDIRECTIONAL PRINTING OFF

When BIDIRECTIONAL PRINTING is selected, the printer will print bidirectionally (in both directions). This provides the fastest print speed. Note that bidirectional printing is totally a function of the printer. Your computer does not need to perform any special preprocessing of the data.

AUTO CR/LF
AUTO CR/LF OFF

When AUTO CR/LF is selected and when the printer carriage reaches the right margin or the right side of the printer frame, a carriage return/line feed will automatically be generated by the printer. Even if AUTO LF is also ON, AUTO CR/LF will only generate one line feed. If not selected, the carriage will remain at the printer's right side until the computer sends a CR/LF.

SPACING

These two switches determine the character spacing. 10, 12, and 15 characters per inch are used for fixed-spacing printwheels (WP type). "WPS" is used for proportional spacing printing (WPS type printwheels).

8 LINES PER INCH
6 LINES PER INCH

This switch selects 8 or 6 lines per inch vertical spacing. Six lines per inch is most commonly selected.

AUTO LF
AUTO LF OFF

When some computers send a line of characters to a printer, they end the line with only a carriage return. Unless a line feed (LF) is also issued, the paper will not advance. When selected, Auto LF causes the printer to advance the paper one line when a carriage return is received. This saves you from having to rewrite a printer software driver to send both a CR and LF at the end of a line.

FORM LENGTH

These four switches are set to a binary combination that the printer interprets as form length. A standard business letter requires a form length of 11 inches.

SERIAL COMMUNICATIONS INTERFACE

Although your Qume printer may print up to 55 characters per second, this is a relatively slow speed when compared to the speed of a computer system. The QUME CONNECTION does support transmission rates up to 9600 baud, but rates higher than 300 baud quickly fill and overflow the interface module's 500 character receive buffer. Therefore, the QUME CONNECTION requires some method of signalling the host system to stop sending. This signalling is called handshaking, and the QUME CONNECTION can use any of three methods of handshaking with your computer. Two of these methods are based on software commands, i.e., ASCII codes are sent back to the host system, indicating that the QUME CONNECTION can no longer accept data. The third method uses a separate line (DTR, pin 20 on the Interface Connector) to signal the computer via voltage level changes when the interface receive buffer is full or empty.

Handshaking protocols and other critical interface parameters (e.g., baud rate, parity, Modem/No Modem) are set by the DIP switches located on the QUME CONNECTION module. Refer to Setting the DIP Switches for a comprehensive discussion of DIP switch functions. Those DIP switch settings that directly affect serial communications interfacing are discussed in the following paragraphs.

Modem And No Modem Operation

Modem mode is typically selected for use with a standard acoustic coupler data set or for use with a computer that can recognize program commands to stop or continue printing transmission. If modem operation is selected, the ETX/ACK, or XON/XOFF DIP switches must also be set to select the method of software handshaking which matches the host system protocol. In modem operation the DTR (Data Terminal Ready) line is always high (SPACE, +12 Vdc nominal).

No Modem operation (DTR active) is typically used when hardware handshaking is used to provide the host system with the full/empty status of the printer's receive buffer. The state of the Data Terminal Ready (DTR) line on the serial interface connector indicates whether or not the printer is ready for additional data. DTR is high (SPACE, +12 Vdc nominal) when the printer is ready to receive data. DTR is low (MARK, -12 Vdc nominal) when the printer is not ready for data.

When the printer's receive buffer is within 64 characters of being filled, DTR goes low (MARK) and stays in this state until the buffer is within 64 characters of being empty.

Handshaking Protocols

The Qume printer can use either of the following three methods of software handshaking to signal the host system to stop or to continue sending characters.

ETX/ACK - In the ETX/ACK mode, your computer transmits blocks of characters to the printer. Each block must be smaller than the printer's receive buffer (500 characters maximum), and each block must have the ASCII code ETX as its last character. After sending a block of 500 characters or less, the computer stops transmitting. The printer processes the characters (first in, first out) and when it finds the ETX code, it transmits the ASCII code ACK back to the waiting computer, indicating to the host that the last character in that block of data has been processed and the printer is now ready for another block of data.

XON/XOFF HANDSHAKING - In the XON/XOFF mode (independent of Modem/No Modem operation) the ASCII codes DC1 (XON) and DC3 (XOFF) are sent by the printer to provide your computer with status on the printer's receive buffer. When the printer's receive buffer is within 64 characters of being full, the printer will transmit the ASCII code DC3 (XOFF) to the computer, indicating that the computer should stop transmission. When the printer's receive buffer is within 64 characters of being empty, the printer will transmit a DC1 (XON) to the computer, indicating that the computer may continue sending. (When XON/XOFF is selected, DTR is always SPACE).

DTR HANDSHAKING - In the DTR mode a separate line (DTR, pin 20 on the Serial Interface Connector) is used to signal the host system via voltage level changes whether the printer receive buffer is full or empty. When DTR is on (Space), your computer transmits characters to the printer until the receive buffer is within 64 characters of being full. DTR is then turned off (Mark) until the receive buffer is depleted to within 64 characters of being empty.

Full and Half Duplex Operation

The Qume printer can be used in either full or half duplex operation. If your computer has an explicit requirement for the printer duplex mode, the duplex switch can be set to match. Note that pin four on the interface connector, REQUEST TO SEND, is only active when Half Duplex operation is selected.

Transmit and Receive Data Format

Qume Sprint 11 PLUS printers equipped with the QUME CONNECTION RS-232-C module transmit and receive EIA RS-232-C compatible asynchronous serial data, encoded as specified by ASCII standard No. X3.4-1968 of the American National Standards Institute.

Receive and transmit signal voltages are nominally ±12 VDC. Each ASCII code includes seven bits of binary data. Refer to the ASCII Code Chart in Appendix A. When the ASCII code is transmitted, three (sometimes four) more bits of binary information must be added to for a total of ten (sometimes eleven) bits of binary data. These additional bits of information identify the beginning and end of each code and provide error recognition capability.

An EIA RS-232-C data line will be in a mark state (-12 VDC nominally) between code transmissions. Transmission of a code is begun by the transmitting device (1) raising the data line to a space state (+12 VDC nominally). The data line is left in the space state for the time period of one bit. This bit time varies depending on the system's baud rate (e.g., 110 baud equals 0.09 ms per bit, 1200 baud equals 833 usec per bit). This first bit period is called the start bit and identifies the beginning of a code transmission.

The next seven bits of data are the seven ASCII code bits, least significant bit first. An ASCII code bit that is a logic "1" corresponds to an EIA RS-232-C data line mark state (-12 VDC nominally).

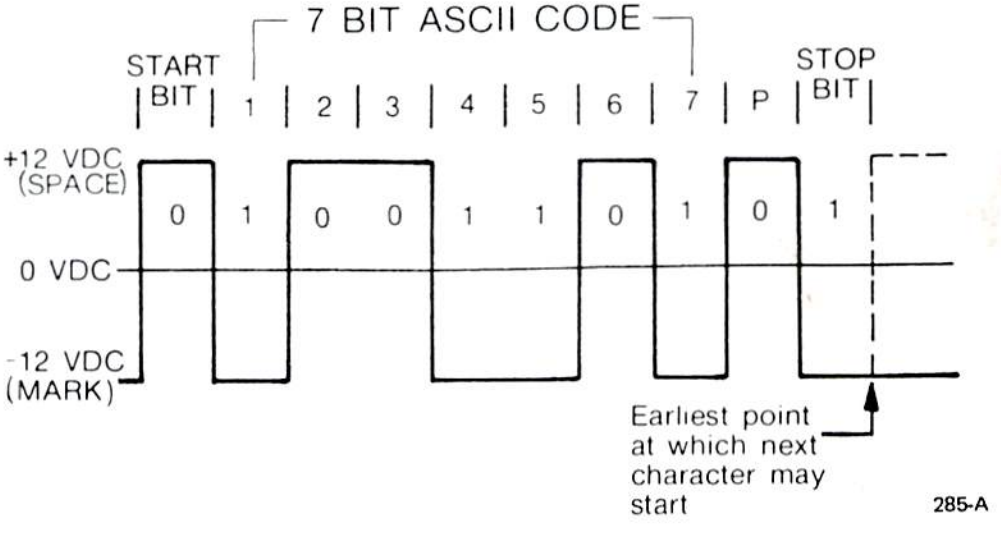


Figure 5. Transmit and Receive Data Format

The next bit (the eighth bit, not counting the start bit) is called the parity bit. Its voltage level during the transmission of any given character depends on (1) the setting of the parity switch and (2) the data in the seven ASCII code bits (for odd and even parity). The parity bit can be used in a communications system to detect certain types of transmission errors. The parity bit will be transmitted in a mark or space state as follows:

MARK PARITY - The printer will ignore the state of the parity bit when receiving data and will always set the parity bit in the mark state when transmitting data.

SPACE PARITY - The printer will ignore the state of the parity bit when receiving data and will always set the parity bit in the SPACE state when transmitting data.

EVEN PARITY - When transmitting data, the printer will set the parity bit in either the MARK or SPACE state as required, such that there will be an "even" number of logic "1" bits transmitted (excluding START or STOP bits). When receiving data, the printer will check to see if there are an "even" number of logic "1" bits in the received code (excluding START or STOP bits). If there are not an "odd" number of logic "1" bits, a PARITY ERROR has been detected. Refer to the Error Conditions discussion later in this section for further details.

ODD PARITY - When transmitting data, the printer will set the parity bit in either the mark or space state as required, such that there will be an odd number of logic "1" bits transmitted (excluding start or stop bits). If there are not an odd number of logic 1 bits, a parity error is detected.

The last bit of data transmitted is the stop bit(s). The data line must be brought low to the mark state for a minimum of one bit period (minimum of two stop bit periods for 110 baud operation). Transmission of the next code can begin immediately following the stop bit(s), or the data line can be left idle in the mark state.

Communication Errors

When a parity error, framing error, or overrun error is detected, the QUME CONNECTION will sound the audible alarm once and enter the ASCII code 5E (hex) in the receive buffer. As a result the printer prints a character (" " on the Prestige Elite ASCII 96 printwheel, PN 82167; "n" on WPS printwheels; "©" or another symbol on some printwheels).

Interface Connector and Cable

A 25 conductor male connector (Cinch or Cannon, type DB-25P) is located on the QUME CONNECTION RS-232-C module cable. Figure 18 illustrates the serial interface connector pins.

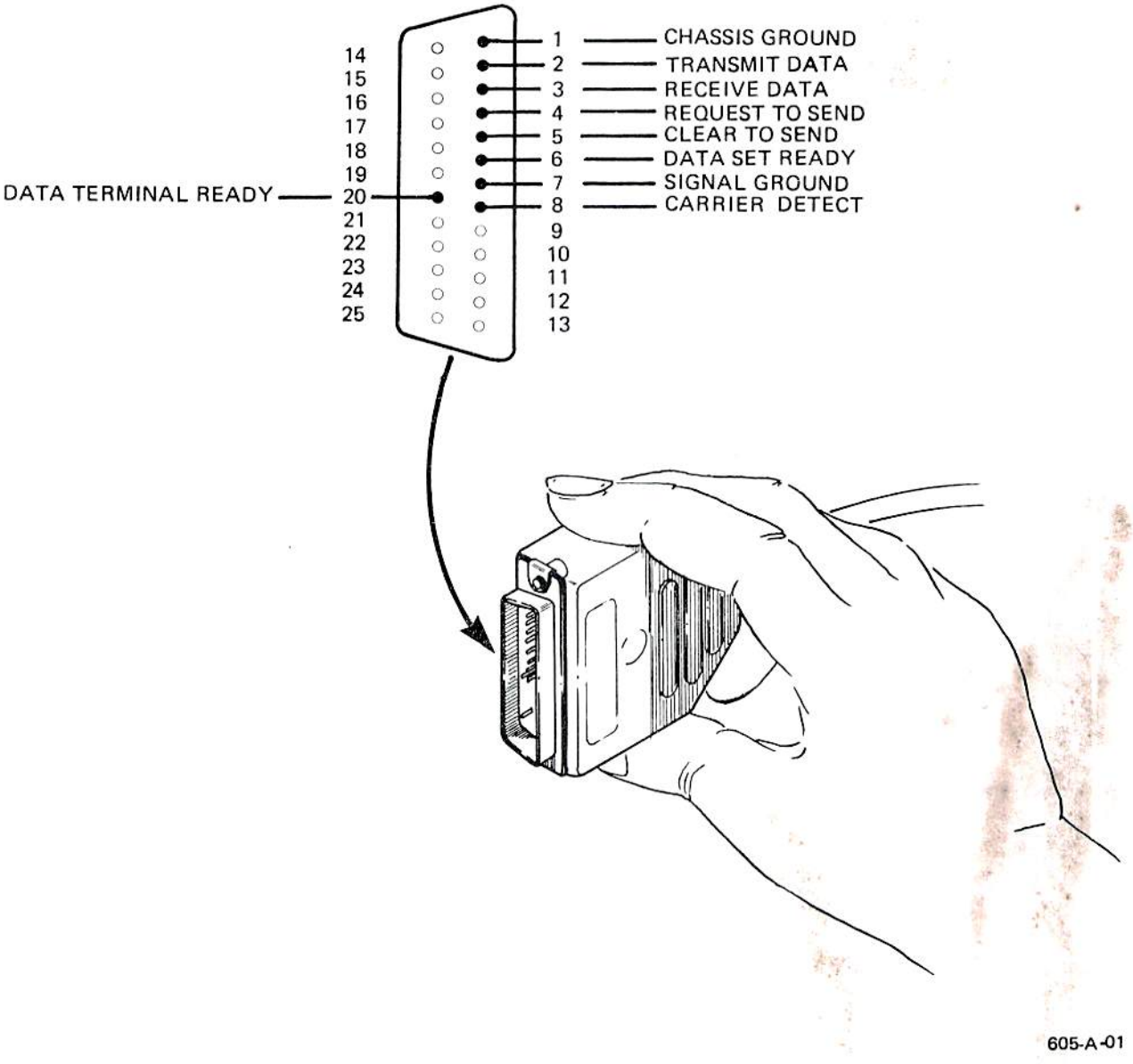


Figure 6. Serial Interface Connector Pins

Serial Interface Signal/Pin Designations

The following table provides pin designations for the interface connector and functional descriptions of signals.

Table 1. Serial Interface Signal/Pin Designations

EIA Pin Number	EIA Signal Name	Function
1	AA, PROTECTIVE GROUND	Chassis or frame ground
2	BA, TRANSMIT	Serial ASCII coded data transmitted from the printer to the computer. Logic 0 is SPACE; Logic 1 is MARK. Between characters, this line assumes a MARK (low) state.
3	BB, RECEIVE	Serial ASCII coded data received by the printer. Logic 0 is SPACE; logic 1 is MARK. Between characters, this line assumes a MARK state.
4	CA, REQUEST TO SEND (RTS)	Output from the printer. This signal is active only when both Modem and Half Duplex are selected. If these DIP switches are selected, SPACE indicates there is no data to send. MARK indicates that the printer has data to send. When Full Duplex and No Modem are ON, RTS is always SPACE.
5	CB, CLEAR TO SEND (CTS)	Input to the printer. This signal is not used by the printer.
6	CC, DATA SET READY (DSR)	Input to the printer. The DATA SET READY line is not used by the printer.
7	AB, SIGNAL GROUND	Ground reference for all data and control signals This pin is internally strapped to pin 1.
8	CF, CARRIER DETECT	Input to the printer; This line is not used by the printer.
20	CD, DATA TERMINAL READY (DTR)	Output from the printer. This signal is only active when both No Modem and DTR are selected. If these DIP switches are not selected, DTR is always SPACE (+12 Vdc nominal). When these DIP switches are selected, SPACE indicates the printer is ready for data; MARK indicates that the printer is not ready for data. DATA TERMINAL READY will be on (Space) until the character receive buffer is within 64 characters of being full. Once the DATA TERMINAL READY has been turned off, it will not be turned back on (Space) until the receive buffer is depleted to within 64 characters of being empty.

COMPUTER - PRINTER OPERATION

Two basic conditions must be satisfied before your Qume printer will print. First, the computer must have the hardware capability to present the data in serial form to the QUME CONNECTION interface connector. This capability is usually provided by the computer manufacturer or the supplier of the computer interface card. If your computer doesn't have a serial port, you've purchased the wrong QUME CONNECTION interface module.

Secondly, the computer must have the software capability of presenting the correct character and/or command sequence of data to the QUME CONNECTION. Most of the popular operating systems for microcomputers (CP/M, Apple DOS, TRS-DOS, MS-DOS, to name a few) have software for a "printer port" or "listing device." The operating system should have been customized for your particular computer by the manufacturer or dealer so that when you tell the computer to print, the operating system knows where in your computer system to send the output.

When you receive an operating system with your computer, you usually also receive some type of "set-up" or "configure" program which allows you to set-up and customize the printer output port. Check your computer reference manual for information on changing and configuring your computer for the proper output port for the printer.

With the operating system appropriately customized and the output port properly configured, the QUME CONNECTION can receive data from your computer. Once this data is received, the QUME CONNECTION interface module must determine whether the data represents a printable character or a printer command (such as paper movement). Finally, this information must be passed from the QUME CONNECTION to the Qume printer for execution.

Once you have the required hardware and software, you are ready to print. If you have completed all of the following tasks, you should be ready to begin printing:

1. Have you plugged the QUME CONNECTION RS-232-C into the back of your printer?
2. Have you installed a printwheel, ribbon cartridge, and paper in the printer?
3. Have you installed the AC power cord?
4. Have you successfully run both the Printer Self-Test and the Terminal Self-Test?
5. Have you hooked the QUME CONNECTION DB-25P male connector to the RS-232-C port on your computer? If your computer also has a male connector, you will have to purchase a sex changer cable.
6. Have you correctly set the DIP switches on both the QUME CONNECTION and the Qume printer to match the requirements of your computer?

With these procedures completed, you are ready to see if the computer actually sends characters to the printer. Enter and run a simple program in Basic, such as:

```
10 LPRINT "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG'S BACK"
```

Note that in Microsoft™ Basic, LPRINT causes the character to be sent to the computer's printer port. As indicated in the following list, other popular computers use a variety of commands to cause a character to be sent to the computer's serial port:

Apple II - PR#1 is commonly used for printer output; After you enter PR#1 the output will all be sent to slot number 1 in the Apple (usually the printer interface card). The output may or may not also be sent to the monitor screen. PR#1 can be a direct command or a command within Basic. Remember that although the Qume printer is capable of printing upper and lower case characters, the Apple II requires additional software to generate lower case characters for the printer.

Microsoft Basic (including Radio Shack, Osborne, IBM PC) - LLIST or LPRINT are Basic commands for line printer output;

CP/M Systems - Several print options are available under CP/M. With the printer configured as a LST: device, PIP LST:=[filename.ext] prints out the desired file. Control-P sends the console output to the printer as well as to the console. Note that printer driver software is not supplied by Digital Research, the writers of CP/M, but is part of the customizing software called the BIOS.

PC DOS - The parallel port is generally the default printer port on the IBM PC. To communicate with the QUME CONNECTION RS-232 interface module you first need to install IBM's Asynchronous Communication Adapter card in your computer. You then must use the MODE command to set the serial card parameters and to assign the printer port to the communications card. Appendix F of this manual provides specific examples of this procedure. With the serial port properly configured, pressing the **CONTROL** and **PRTSC** keys sends output to the printer as well as to the monitor screen. Pressing the **SHIFT** and **PRTSC** keys will send a single "snapshot" of the monitor screen to the printer. Consult your IBM operations manual for further details.

These examples are typical of the various commands used to output data from the computer to the printer. Refer to Appendix F and to your system documentation to find the equivalent command for your computer. If your computer, the QUME CONNECTION, and the Qume printer are correctly configured and are working properly, the printer will print the desired information.

If the printer does not print, the computer hardware or software is not working right, or you may be using the wrong computer commands. It is unlikely that the Qume printer would be at fault if the Printer Self-Test and the Terminal Self-Test ran properly during installation testing. It is likely, however, that you have improperly set the QUME CONNECTION DIP switches. Review the Serial Interface section of this manual and the interfacing examples provided in Appendix F. Some personal computers are configured as terminals, as is the SPRINT 11 PLUS. When this is the case, a modem eliminator cable must be used before the computer and printer can successfully communicate. Also review the printer interface information in your computer documentation, and make sure that you correctly understand the baud rate, handshaking, and parity your computer uses when transmitting data. The special setup or configuration programs (e.g., MODE for the IBM PC,

SETCOM for the TRS-80 Model II, SETUP on the Osborne) featured on many personal computers will allow you to select the required parameters.

PROGRAMMING THE QUME CONNECTION

QUME PRINTER COMMANDS AND SOFTWARE COMPATIBILITY

The QUME CONNECTION - RS-232-C module interfaces a Qume printer to the outside computer world using an EIA RS-232-C, C.C.I.T.T. compatible serial interface. If you send the printer a letter (upper and lower case), number, symbol (such as !@#$%&*()+="'?/.,), or carriage return, line feed, or form feed, the Qume printer will respond identically to a dot matrix printer. However, the QUME CONNECTION also knows many special commands which allow the printer to set up tabs and margins, and dress up a page with bold and shadow printing. Since the QUME CONNECTION uses the most common letter quality printer commands, most letter quality software (such as Wordstar and Wordpro) will run with the QUME CONNECTION.

Additionally, Qume manufactures over one hundred printwheels with many types of special characters. Special sequence printwheels (such as foreign language printwheels) can be used with the appropriate printer programming. If you have a Qume Bidirectional Forms Tractor, the Qume printer can also be used for graphics. All of these enhancements require that you send special commands to the Qume printer.

If you write software, refer to the following section for a complete discussion of the command set. A notation is given at the end of each command indicating the compatibility of the command with Qume Sprint 5 and Sprint 9/45-55 printers as well as Diablo 630 printers. The format is as follows:

9 - The command is used by the Qume Sprint 9/45-55 printer.
5 - The command is used by the Qume Sprint 5 printer.
D - The command causes the same function to happen on the Diablo 630.

If there is no notation (e.g., the 5 is missing), it means the command is not used by that printer. A missing "D" for Diablo also means that the command may be used by Diablo for another printer function.

For example, (9,D) means that the command is used by the Qume Sprint 9/45-55 and Diablo 630 printers, but not by the Qume Sprint 5.

If you are primarily an end user of software, you may be able to "customize" the software to use some of the QUME CONNECTION commands. It is unlikely that you will be able to make any major changes unless you have the source code to the software. Consult the software program manual to find out if the software can be customized. You would first run an installation program and select the Qume option (Sprint 5 or Sprint 9/45-55). That procedure initializes your software with the basic Qume Sprint 5 or Sprint 9/45-55 commands, which are subsets of the QUME CONNECTION command set. After that, if possible, you may be able to add several of the QUME CONNECTION commands. The commands which are not used by the Sprint 5 are identified in Table 2 with asterisks (*).

PRINTING CHARACTERS

A 96 character Qume printer has a printwheel with 96 characters. When your computer sends the printer any of the 94 ASCII codes 21 through 7E hex, the corresponding character is printed. For example, 41 hex prints an upper case A. The two remaining ASCII codes, SPACE (20 hex) and DELETE (7F hex), are unique; SPACE is really a motion command and DELETE is frequently used to reset the printer. Consequently, a two code ESCape sequence is used to print the characters located at position 002 and 004 on the printwheel. See Special Character Printing in the COMMAND SET discussion for details.

As Qume manufactures over 100 different printwheels in many different languages, the character sequence is not identical for all printwheels. The QUME CONNECTION, however, has the intelligence to allow you to use all available printwheels. For standard sequence printwheels, if the pitch setting (10, 12, 15 for WP type printwheels or WPS for WPS type printwheels) matches the printwheel, the printer knows exactly where to find the character on the printwheel.

Nonstandard sequence printwheels are supported by the Twintellect function. The printer's German Twintellect DIP switch allows the printer to access special look-up tables already present in ROM that support German WP and German WPS printwheels. It would be impossible, however, to store all the look-up tables required for every Qume printwheel. Instead, the QUME CONNECTION provides special commands that allow a user to download to the printer the information necessary to support any other nonstandard printwheel. (See the Twintellect/Download Commands section for details).

THE COMMAND SET

This section describes in detail the Qume Connection program commands. As mentioned in the PREFACE, your application may not require a working knowledge of these program commands. For example, if you are using a prepackaged wordprocessing program, the software manufacturer may have already incorporated those commands required to drive the printer. Many of you, however, will use your Qume printer for a variety of applications and will want to know how to select special printing features such as bold printing and graphics. If you fall into this latter category, study the following sections carefully.

In addition to the printable characters, there are over eighty commands which are recognized by the Qume Connection, ranging from SPACE to AUTOMATIC UNDERSCORE. Commands may be a single code, e.g., LF (line feed). Commands may also be sequences of two, three, four or more (e.g., relative motion commands, tab lists, downloads) codes. For the multiple code commands, you would send the printer the ESCAPE code (hex 1B) followed by one or more codes which tell the printer what to do. Some examples are:

ESC + The two code command for setting the top margin.
ESC SUB I A three code command for initializing the printer.
ESC F d1 d2 A four code command for setting form length. You supply two codes, **d1** and **d2**, to tell the printer the length.

Most commands begin with the ESCape character. The ESCape character tells the printer that the next character or two are special commands. The third and possibly fourth codes are variables which pass printer parameters such as vertical and horizontal distances. These are identified as **d1, d2, n1,** etc.

When commands are sent, the printer can distinquish between upper and lower case. If the command calls for upper case, the computer must send the code for an upper case letter. ESC E is not the same as ESC e.

COMMAND FORMAT

Commands are presented in three forms:

1. ASCII CODES: **ESC +** means that the ASCII ESCape code is sent, and then a plus sign character is sent. These symbols may appear on your keyboard. To clarify our examples we show a space between characters; do not send this space as part of the command.

2. DECIMAL CODES: The equivalent decimal values for the command are given. This is useful for Basic programmers. ESCape is 27 decimal, and a plus sign is 43 decimal. A program using Microsoft Basic conventions would send these values (the ESC + command) to the printer as follows:

```
LPRINT CHR$(27);CHR$(43);
```

3. HEX CODES: Hex values for the command are given. For ESC + the hex codes are 1B and 2B.

Commands are organized in this manual according to the following table. Some commands are repeated because they logically fall into more than one category. An asterisk (*) indicates that the command is not used by the Qume Sprint 5.

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Set Form Length: ESC F d1 d2 26
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* Auto Carriage Return/Line Feed Off: ESC Z 27
Auto Line Feed On: ESC comma 27
Auto Line Feed Off: ESC period 27
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Print Position 004: ESC SP....51
Print Position 002: ESC /....51

MARGIN COMMANDS

COMMAND:	ASCII CHAR:	HEX / DECIMAL
SET TOP MARGIN:	**ESC +**	1BH,2BH/27,43
SET BOTTOM MARGIN:	**ESC -**	1BH,2DH/27,45

These commands establish the top and bottom margins anywhere within the form length (the top margin cannot go below the bottom margin, obviously).

When the printer is powered up or initialized, the printer assumes the paper is at the top of form (the top edge of the paper); the default bottom margin is the form length set by the printer DIP switches. To set the top margin, the computer system sends a series of line feed commands which move the paper until the desired top margin line (the first line of actual printing) has been reached. Then the computer issues a SET TOP MARGIN command. For example, if the top margin is to be 12 lines down from the top of the paper, the computer sends 12 Line Feeds to the printer then sends a SET TOP MARGIN command. Appendix B provides a simple Basic formatting program that shows how to set the margin.

To set the bottom margin, the computer sends a series of line feeds which correspond to the maximum number of lines to be allowed on a page (assuming we are starting from the top margin, just set.) That moves the paper to where the bottom margin (last line of print) should be. Now the computer sends a SET BOTTOM MARGIN command. When the printer receives a paper feed command (including FORM FEED) which would advance the paper to the bottom margin, the printer will automatically advance the paper to the next top margin. It is not possible to print on the bottom margin.

SET TOP MARGIN and SET BOTTOM MARGIN commands are not affected by line spacing commands. (9)

SET LEFT MARGIN:	**ESC 9**	1BH,39H/27,57
SET RIGHT MARGIN:	**ESC Ø**	1BH,30H/27,48

These commands set the left and right margins in the same way the top and bottom margins are set. The computer first issues a CARRIAGE RETURN command to move the carriage to the left most printing position (column 0), if the carriage is not already there from a power up. Then the computer sends horizontal move commands (such as SPACE) to move the carriage to the desired column and sends a SET LEFT MARGIN command.

To set the right margin, the computer sends horizontal move commands (such as a SPACE) to move the carriage to the desired column for the right margin and then sends a SET RIGHT MARGIN command.

At power-up or printer initialization, the left margin is the leftmost printing position (column 0), and the right margin is the right sideframe. The carriage will return to the left margin following a CARRIAGE RETURN, but the carriage can still be moved beyond the left margin with BACK SPACE and other leftward carriage move commands.

SET LEFT MARGIN and SET RIGHT MARGIN commands are not affected by character spacing commands. (5,9,D)

RIGHT MARGIN CONTROL ON: ESC O (letter) 1BH,4FH/27,79
RIGHT MARGIN CONTROL OFF: ESC Y 1BH,59H/27,89

If Right Margin Control is ON, the carriage will automatically perform a CARRIAGE RETURN after reaching the right margin Hot Zone.

The Hot Zone is a space equal to 5 character spaces preceding the right margin. A CARRIAGE RETURN and LINE FEED will be executed as soon as the first SPACE occurs within the Hot Zone. If a SPACE is not encountered in the Hot Zone, then the CARRIAGE RETURN and LINE FEED will execute as soon as a SPACE occurs after the right margin. If no SPACE occurs, then the CARRIAGE RETURN and LINE FEED will execute upon reaching the end of the platen. Note that the right margin location is not affected by the horizontal space increment definition (column width, pitch).

RIGHT MARGIN CONTROL commands are not affected by the AUTO LF mode. (5,9)

LINESPACING (VERTICAL) COMMANDS

COMMAND:	ASCII CHAR:	HEX / DECIMAL
DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS:	**ESC L d1 d2**	1BH,4CH/27,76

Normally, the line feed distance is set by the printer which reads the DIP switches (6 or 8 lines per inch) upon power up or printer initialization. However, line feed distance may also be set by a software command from the computer.

This four code command is used to define the line feed distance in 1/48 inch increments. To find **d1** and **d2** you must first know the line feed distance in 1/48 inch increments. For example, 3 inches = 144/48 inches.

d1 is the hex equivalent of the tens; **d2** is the ones.

In the example above, there are 14 tens in 144. (The integer of 144/10 is 14.) 14 decimal = E hex. Hence, **d1** is E. **d2** is **4.** Consequently, the computer sends the printer **ESC L E 4,** a sequence of four ASCII characters. When the line feed distance is 99/48 inch or less, no hex conversion is necessary since 0 to 9 is the same in hex or decimal.

Invalid parameters are ignored; maximum distance is 159/48 inches. If either **d1** or **d2** is zero, the digit 0 must be entered. You must, for example, send **09** and not **9.** (5,9)

This command does not affect the margins or the absolute value of the form length.

DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS,
ALTERNATE: ESC RS (distance + 1) 1BH,1EH/27,30

This command provides another method of defining line spacing, but the maximum distance is 125/48 inch.

For example, 1/4 inch = 12/48 inch. Add 1 to 12 = 13. The computer sends ESC RS (13), or 1B 1E 0D hex.

The equivalent Basic command would be **LPRINT CHR$(27);CHR$(30);CHR$(13);**

(5,9,D)

SET FORM LENGTH: ESC F d1 d2 1BH,46H/27,70

Normally, form length is set by the printer DIP switches, which are read on power-up or printer initialization. However, the form length may also be set by software command from the computer.

Form length may be a distance of 1/6 inch to 127/6 inches (21 1/6 inches). **d1** and **d2** are determined the same way as the LINE FEED INCREMENTS above, except that 1/6 inch increments are used, not 1/48 inch.

d1 represents the hex character of the tens. **d2** is the ones. For example, a form length of 17 inches = 102/6 inches. 102 has 10 tens and 2 ones. Therefore, **d1** = A (the hex equivalent of 10 decimal), and **d2** = 2. The computer sends ESC F A 2.

Whenever the form length is changed, the current vertical position is set as the top of form and the top margin. The bottom margin is set at the end of form.

Note that before the SET FORM LENGTH command is sent, you should physically adjust the paper to the top of form because the printer is going to assume the current paper location is top of form. (5,9)

AUTO CARRIAGE RETURN/LINE FEED ON: ESC W 1BH,57H/27,87
AUTO CARRIAGE RETURN/LINE FEED OFF: ESC Z 1BH,5AH/27,90

Normally, this function is selected by a printer DIP switch. The computer may also select or change this function.

Selecting AUTO CARRIAGE RETURN/LINE FEED (on) will cause the printer to automatically perform a CARRIAGE RETURN and a LINE FEED when the carriage reaches the right margin (or right printer side if right margin is not set).

If the printer is in either Graphics mode, the Auto Carriage Return/Line Feed mode is ignored. (5,9)

AUTO LINE FEED ON: ESC comma 1BH,2CH/27,44
AUTO LINE FEED OFF: ESC period 1BH,2EH/27,46

Normally, this function is selected by a printer DIP switch. The computer may also select or change the function.

When AUTO LINE FEED is selected (ON) and the printer receives a CARRIAGE RETURN, the printer will also perform a LINE FEED. This is an extremely useful function if the computer sends only a CARRIAGE RETURN at the end of a line. If this function is selected and the computer sends a CR and LF, the printer will add another LF and double space the print. (5,9)

CHARACTER SPACING (HORIZONTAL) COMMANDS

DEFINE HORIZONTAL SPACE INCREMENTS: ESC E d1 d2 1BH,45H/27,69

This command changes the distance the carriage moves after a character is printed or whenever the computer issues a SPACE or BACKSPACE command. This distance is normally determined by the pitch setting from the printer DIP switches. For 10 pitch (10 characters per inch) printwheels, the carriage moves 1/10 inch. In WPS mode carriage movement is proportional to the width of the character, and SPACE and BACKSPACE commands always cause the carriage to move 1/12 inch.

The distance of this horizontal movement is changed by the computer when a DEFINE HORIZONTAL SPACE INCREMENT command is issued. This command will override the previous setting (DIP switch or command). A maximum increment of 159/120" is possible.

d1 and **d2** are determined in the same way as the line feed spacing, except that the distances are in 1/120 inch instead of 1/48 inch. **d1** represents the hex character of the tens; **d2** is the ones.

Since this command defines spacing, it will also affect the location of tabs. For further important information on this subject, refer to the HORIZONTAL TAB STOP command description. (5,9)

DEFINE HORIZONTAL SPACE INCREMENTS
ALTERNATE: ESC US (distance + 1) 1BH,1FH/27,31

This command defines the SPACE distance the same way the ALTERNATE VERTICAL SPACING (LINE FEED) INCREMENT, ALTERNATE works. The horizontal distance is measured in 1/120 inches. This command allows a maximum increment of 125/120". Refer to the DEFINE VERTICAL SPACING (LINE FEED) INCREMENTS, ALTERNATE section for details on calculating the distance parameter in this command. (5,9,D)

WPS ON: ESC $ 1BH,24H/27,36
WPS OFF: ESC % 1BH,25H/27,37

Normally, pitch (character spacing) is determined by the setting of the printer DIP switches. The pitch must match the type of printwheel used. WP printwheels use 10, 12, or 15 pitch; WPS printwheels are used for proportional space printing and must use the WPS setting. Proportional spacing means that the space a character occupies depends on the width of the character. For example, the letter M is wider than the number 1; therefore, the carriage moves more for an M than for a 1.

Using these commands, your computer can turn WPS on or off. Note that these commands take precedence over the setting of the pitch DIP switches.

Columns are established and defined at 12 pitch or according to the DEFINE HORIZONTAL SPACING INCREMENTS command. (9,D)

TAB COMMANDS

COMMAND:	ASCII CHAR:	HEX / DECIMAL
SET HORIZONTAL TAB STOP:	ESC 1	1BH,31H/27,49
CLEAR HORIZONTAL TAB STOP:	ESC 8	1BH,38H/27,56

The Qume printer has electronic tabs in the same way a typewriter has mechanical tab stops. The computer may set or clear the tabs by command. Tabs are column dependent, and their physical position across the page will be a function of the pitch setting (character spacing). For example:

- At 10 pitch there are a total of 132 possible tabs.
- At 12 pitch there are a total of 158 possible tabs.
- At 15 pitch there are a total of 197 possible tabs.

Tabs will always track the pitch setting. A tab set at column 50 will always be at column 50. If a tab is set for column 150 at 12 pitch, and the pitch is changed to 10 characters per inch, the tab will be moved beyond the right end of the platen since there are only 132 tab positions at 10 pitch. In this case, a tab to column 150 will cause the carriage to move to column 132, or the last column on the page. You should anticipate this effect when changing pitch (character spacing). Remember that the printer stores the tabs as column numbers and not as physical locations. The maximum number for a tab stop column is 200. Columns after number 200 cannot be used for tab stops.

To set a tab stop, the computer moves the carriage to the desired column and then issues the SET HORIZONTAL TAB STOP command. To clear an individual tab stop, a CLEAR HORIZONTAL TAB STOP is sent instead of the SET command. (5,9,D)

CLEAR ALL HORIZONTAL TAB STOPS: ESC 2 1BH,32H/27,50

This command will clear all horizontal tab stops. The printer clears the tab stops by erasing a table in its memory. Tab stops will also be cleared following a restore command or when the printer is powered up. (5,9,D)

SET TAB LIST: ESC (list 1BH,28H/27,40
CLEAR TAB LIST: ESC) list 1BH,29H/27,41

This command allows the computer to set or clear up to 159 tabs at one time. To implement the SET TAB LIST function, the computer transmits **ESC (**, and then follows with a series of two digit values from 00 to F9, where the first character is the hex equivalent of the tens and the second is the ones. This value is not a hex value (e.g., F0 is NOT 240 decimal) but the same value used in the vertical line spacing command. Each value represents a column where a tab is to be set. After each value, the computer must transmit an ASCII comma, and the last value must be followed by an ASCII period.

For example:

- Set tab stops at columns 05, 43, 79 104, 109 (all decimal).
- The characters to be sent will be 05, 43, 79, A4, A9.
- The command is **ESC (0 5 , 4 3 , 7 9 , A 4 , A 9 .**
- In Basic, the command would be as follows:

```
LPRINT CHR$(27);CHR$(40);"05,43,79,A4,A9.";
```

Tab stops set in this manner are subject to the same factors that affect the SET HORIZONTAL TAB STOP command. Refer to that command description for important details. Tab stops set in this manner may be listed in any order. (5,9)

PAPER MOVEMENT (VERTICAL MOTION) COMMANDS

COMMAND: ASCII CHAR: HEX / DECIMAL

LINE FEED: LF 0AH/10

Paper is moved one linespace. The line feed distance is determined by one of the following:

- LINE SPACE switch setting
- DEFINE VERTICAL SPACE INCREMENT - ESC L (d1) (d2)
- DEFINE VERTICAL SPACE INCREMENT, ALTERNATE - ESC RS (n)

In both GRAPHICS ON modes (1/60" and 1/120") LINE FEED distance equals 1/48". (5,9,D)

NEGATIVE LINE FEED: ESC LF 1BH,0AH/27,10

This command will cause the paper to move backward to the previous line. The negative line feed distance is determined by the same commands which define the line feed distance. In both GRAPHICS ON modes, NEGATIVE LINE FEED distance equals 1/48". (5,9,D)

1/2 LINE FEED: ESC U 1BH,55H/27,85

Paper is moved one-half linespace. This command is frequently used for subscripts. If the line feed distance has been defined as an odd number of 1/48 inch increments, then a 1/2 LINE FEED command will move paper half the line feed distance rounded down to the next lowest 1/48" increment. Neither of the GRAPHICS ON modes affects this command.(5,9,D)

NEGATIVE 1/2 LINE FEED: ESC D 1BH,44H/27,68

Paper is moved one half linespace in the direction opposite to a LINE FEED operation. This command is frequently used for superscripts. If the line feed distance has been defined as an odd number of 1/48 inch increments, then a negative 1/2 LINE FEED command will move paper one half the line feed distance rounded down to the next lowest 1/48" increment. Neither of the GRAPHICS ON modes affects this command. (5,9,D)

AUTO CARRIAGE RETURN/LINE FEED ON: ESC W 1BH,57H/27,87
AUTO CARRIAGE RETURN/LINE FEED OFF: ESC Z 1BH,5AH/27,90

The AUTO CARRIAGE RETURN/LINE FEED ON command causes the printer to automatically issue a carriage return/line feed when the printer carriage reaches either the right margin or right side of the printer frame. If this command is turned OFF, the carriage remains at the right side of the printer frame until the computer sends a CR/LF. Only one line feed is generated if both this function and AUTO LF are both selected.(5,9)

ABSOLUTE VERTICAL TAB TO A LINE NUMBER: ESC P d1 d2 1BH,50/27,80

This command moves paper either up or down to a line number specified by **d1 d2**, a two digit number which can define a maximum of 127 line locations. **d1** and **d2** are the hex value of the tens and the value of the ones, respectively (the same as the LINE SPACE INCREMENT value used earlier). Line numbering begins at the Top of Form, Line 00. For example, to move the paper to Line 117:

d1 is 11 tens, or B in hex; **d2** is 7. The command is **ESC P B 7.**

This command is directly or indirectly affected by the following:

- LINE SPACE switch setting
- DEFINE VERTICAL SPACE INCREMENT: ESC L d1 d2
- DEFINE VERTICAL SPACE INCREMENT, ALTERNATE: ESC RS (n)
- FORM LENGTH switch settings
- SET FORM LENGTH: ESC F d1 d2
- SET BOTTOM MARGIN: ESC -
- SET TOP MARGIN: ESC + (5,9)

ABSOLUTE VERTICAL TAB TO A LINE NUMBER
ALTERNATE: ESC VT (distance + 1) 1BH,0BH/27,11

This method of moving the paper to a line number uses the same method as the alternate method of specifying the line spacing used earlier. The command defines a maximum line number of 125.

For the example, to move the paper to line 117, the Basic command is

```
LPRINT CHR$(27);CHR$(11);CHR$(118);
```

This command is directly or indirectly affected in the same manner as the ABSOLUTE VERTICAL TAB TO A LINE NUMBER: ESC P d1 d2 command. (5,9,D)

RELATIVE VERTICAL (PAPER FEED) MOTION: ESC V n1 n2 n3 1BH,56H/27,86

This command moves paper up or down in increments of 1/48", to a maximum of 1791/48" (37.3"). **n1 n2 n3** is the hex value of the distance represented by 3 ASCII characters. The characters used for the hex value are offset by an ASCII bias:

1. **n1** is the number of 256's plus: ASCII '@' (40 hex), for right or up; ASCII 'P' (50 hex), for left or down.

2. **n2** is the number of 16's plus ASCII '@' (40 hex).

3. **n3** is the number of ones plus ASCII '@' (40 hex). (5,9)

Our example will show how to move the paper up a distance of 10 inches (from its current line number).

1. First determine the number of 1/48" in 10": 480.

2. 480 = (1 x 256) + (14 x 16) + (0 x 1). The three values will be based on the underlined numbers 1, 14, and 0.

3. Convert 1, 14, and 0 decimal to hex base: 1=1, 14=E, 0=0. These two steps converted 480 decimal to 1E0 hex.

4. Add 40 hex: 1+40=41 (the n1 value). E+40=4E (the n2 value); 0+40=40 (the n3 value).

5. The command is ESC V A N @, or hex: 1B 56 41 4E 40

FORM FEED: FF 0CH/12

This command moves paper to the next top of form. If top and bottom margins are set, the paper will move to the top margin of the next form. The form length distance is determined by one of the following:

- FORM LENGTH switch setting (printer DIP switches)
- SET FORM LENGTH: ESC F d1 d2 program command.

A FORM FEED will terminate the Underscore mode.

If Qume's mechanical sheetfeeder is installed on the printer, a FORM FEED command will automatically eject the sheet of paper currently in the printer, load the next sheet of paper, and move the loaded sheet of paper to the desired print position. (5,9,D)

CARRIAGE MOTION (HORIZONTAL MOTION) COMMANDS

COMMAND: ASCII CHAR: HEX / DECIMAL

HORIZONTAL TAB: HT 09H/9

This command causes the carriage to move to the first set tab stop to the right.

If no tab stops have been set to the right of the current carriage position, the carriage will move to the end of the platen. (5,9,D)

ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER: ESC C d1 d2 1BH,43H/27,67

This command works the same way as the ABSOLUTE VERTICAL TAB TO A LINE NUMBER command. This command moves the carriage to a specific column with the range of 0 to 159. **d1 d2** is a two digit number that can represent any column in this range. **d1** is the hex value of the tens; **d2** is the value of the ones. As an example, to move the carriage to column number 130:

d1 is 13, which is hex C. **d2** is 0.

The command is ESC C C 0. In Basic: **LPRINT CHR$(27);"CC0";**

Columns are space distant dependent. An ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER is therefore affected by the same switches and set-up and define commands that affect the SPACE command. Refer to the SPACE command for detailed information. Any attempt to tab to a column number beyond the right end of the platen will cause the carriage to move to the right end of the platen.

In the WPS mode, columns are defined at 12 pitch or according to the DEFINE HORIZONTAL SPACING INCREMENTS command.

HORIZONTAL TAB commands are affected by, or affect, the following:

- SET HORIZONTAL TAB STOP: ESC 1.
- TAB SET LIST: ESC (list
- DEFINE HORIZONTAL SPACING INCREMENTS: ESC E d1 d2
- DEFINE HORIZONTAL SPACING INCREMENTS, ALTERNATE: ESC US n
- PITCH switch
- Motion minimization
- AUTO UNDERSCORE mode. (5,9)

ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER
ALTERNATE: ESC HT (column number + 1) 1BH,09H/27,9

This command moves the carriage to a specific column within the range of 0 to 125 using a single ASCII character. For example the following Basic commands move the carriage to column 56.

```
DISTANCE = 56 + 1
LPRINT CHR$(27);CHR$(9);CHR$(DISTANCE);     (5,9,D)
```

RELATIVE HORIZONTAL CARRIAGE MOTION: ESC H n1 n2 n3 1BH,48H/27,72

This command works the same way as the RELATIVE VERTICAL MOTION command. This command moves the carriage left or right any number of 1/120" increments between 0/120" and 1584/120". Refer to the examples in the RELATIVE VERTICAL MOTION command to determine **n1 n2 n3.**

Commands which would cause the carriage to move beyond the platen limits are ignored. Motion minimization is in effect. (5,9)

BACKWARD PRINT: ESC 6 1BH,36H/27,54

This command reverses the normal carriage motion direction. The BACK SPACE will cause the carriage to move from left to right. The HORIZONTAL TAB, RELATIVE HORIZONTAL CARRIAGE MOTION, and ABSOLUTE HORIZONTAL TAB commands are not affected. In addition, this command does not alter any vertical motion direction.

This command is terminated by the FORWARD PRINT command or a CARRIAGE RETURN command. If the CARRIAGE RETURN is used to terminate backward printing, the carriage will return to the left margin. (5,9,D)

FORWARD PRINT: ESC 5 1BH,35H/27,53

This command is used to terminate the BACKWARD PRINT mode commands. (5,9,D)

AUTO BIDIRECTIONAL PRINTING ON: ESC < 1BH,3CH/27,60
AUTO BIDIRECTIONAL PRINTING OFF: ESC > 1BH,3EH/27,62

These commands place the printer in the Automatic Bidirectional Printing mode. This function is normally selected by a DIP switch, but the function may also be selected or changed by the computer.

The printer is more efficient if it prints in both directions. To do this received characters are stored in a buffer in the printer until a CARRIAGE RETURN or LINE FEED character is received (indicating the end of a line of text). Then the printer actually prints the line. For the bidirectional mode to work the printer buffer has to be kept partially full. If the printer processes all of the characters in the buffer, it will move the carriage back to the left margin when it finds the CARRIAGE RETURN character. None of this work is of any concern to your computer system; it is all done inside the printer. Bidirectional printing may be turned off either by the DIP switch on the printer or by this command.

The AUTO BIDIRECTIONAL PRINTING command takes precedence over the setting of the AUTO BIDIRECTIONAL PRINTING switch. Also note that when UNDERSCORE ON or tabs are used, the carriage moves only from left to right. (9)

SPACE: SP 20H/32

This is the standard command which moves the carriage one space (between words, for example). There is nothing complicated about the command but the printer follows rules in determining how far and in what direction the carriage is going to be moved:

- The PITCH switch determines the distance of a column width. In 10 pitch the distance will be 1/10 inch; for 12 pitch 1/12 inch; for 15 pitch 1/15 inch; for WPS (proportional spacing) 1/12 inch.

  DEFINE HORIZONTAL SPACING INCREMENT commands will override the pitch switch or the previous setting.

- A SPACE in the BACKWARD PRINT mode will move the carriage to the left.

- Commands which affect the SPACE distance and direction are:

  AUTO CARRIAGE RETURN/LINE FEED switch
  AUTO BIDIRECTIONAL PRINTING switch
  AUTO BIDIRECTIONAL PRINTING ON: ESC <
  BACKWARD PRINT: ESC 6, or FORWARD PRINT: ESC 5
  AUTO CARRIAGE RETURN/LINE FEED ON - ESC W
  GRAPHICS ON 1/60": ESC 3, or GRAPHICS ON 1/120": ESC G
  RIGHT MARGIN CONTROL ON: ESC O (5,9,D)

BACKSPACE: BS 08H,8

This command causes the carriage to move one space in the opposite direction of SPACE. Normally BS moves the carriage to the left (in backwards print mode it moves the carriage to the right). Back space distance and direction are affected by the same control switches and commands as the SPACE command. Note that in the WPS mode, all backspace commands are fixed at 1/12". Do not confuse backspace with DELETE or RUBOUT. (5,9,D)

BACKSPACE 1/120": ESC BS 1BH,08H/27,8

This command causes the carriage to move 1/120" (normally to the left). Setting the Horizontal Space Increment to 1/120" and using the BACKSPACE command achieves the same result. (5,9,D)

CARRIAGE RETURN: CR 0DH/13

This is the standard "end of line" command. This command causes the carriage to move to the left margin. The CARRIAGE RETURN command terminates the following printer modes:

GRAPHICS ON, 1/60": ESC 3;
GRAPHICS ON, 1/120": ESC G;
BACKWARD PRINT: ESC 6

The CARRIAGE RETURN affects, or is affected by, the following functions:

AUTO CARRIAGE RETURN/LINE FEED switch and command
AUTO BIDIRECTIONAL PRINTING switch and command
RIGHT MARGIN CONTROL ON: ESC O
UNDERSCORE ON: ESC I.

Refer to the appropriate control switch or command description for more detailed information. (5,9,D)

PRINTING COMMANDS

COMMAND: ASCII CHAR:	HEX / DECIMAL
UNDERSCORE ON: ESC I	1BH,49H/27,73
UNDERSCORE OFF: ESC J	1BH,4AH/27,74

In the Underscore (underline) mode, the printer will automatically underscore characters, words, phrases, sentences, paragraphs, etc. as identified by the host system.

When the Underscore mode is turned ON, the printer will underline all text following the UNDERSCORE ON command until the UNDERSCORE OFF command is received.

The printer does not underline each character as received but waits until it receives a Carriage Return, any paper motion command, or UNDERSCORE OFF and goes back and underlines all of the text which is to be underlined.

The following functions will also occur:

- Horizontal space that is tabbed over will be underscored.
- Bold Overprint mode ON will cause multiple strike underscores.
- Moving the carriage to the left of the Underscore mode "start" point before causing underscore execution may have unexpected results. (5,9)

BOLD OVERPRINT ON: ESC K d	1BH,4BH/27,75
BOLD OVERPRINT OFF: ESC M	1BH,4DH/27,77

This command will cause the print hammer to fire **d** times for each printed character before the carriage is moved to the next character's position. **d** is a number between 1 and 4. The procedure for overprinting text three times is:

- Send an **ESC K 3**, or **LPRINT CHR$(27);CHR$(75);"3";**
- All of the text will be overprinted 3 times until BOLD OFF is sent or until d is changed.

SHADOW PRINT ON: ESC Q	1BH,51H/27,81
SHADOW PRINT OFF: ESC R	1BH,52H/27,82

This command will cause all characters to be printed twice, with the second printing occuring 1/120" from the first. The darker headings in this manual are printed with shadow print. What word processors and similar software call "bold" may actually be shadow print.

After SHADOW PRINT ON is sent, all text will be printed with shadow print until SHADOW PRINT OFF is received.

The printer observes the following rules:

WPS mode: Spacing is not adjusted to accommodate the additional 1/120" displacement. Consequently, a line of shadow printed text in WPS mode is longer than the same line produced when shadow print is off.

Non-WPS mode printing: Character spaces will be reduced to maintain column integrity.

Backward Printing mode: The primary character is printed first, then the shadow character.

In Bold Overprint mode and Shadow Print Mode: The first character will overprint, the second will single print.

(9)

NO PRINT ON: ESC S 1BH,53H/27,83
NO PRINT OFF: ESC T 1BH,54H/27,84

The NO PRINT ON command will inhibit the firing of the print hammer and the operation of ribbon feed and printwheel motors during the printing of characters, without affecting any other function. NO PRINT is used to mask passwords, etc. NO PRINT OFF is normal. (5,9)

GRAPHICS COMMANDS

Qume's letter quality printers are most frequently used for preparing text. However, the printer can also be used for graphics. It recognizes a set of graphics commands which allows resolution of 60 or 120 points per inch horizontally and 48 points per inch vertically (5760 points per square inch). The Bidirectional Tractor enhances printer registration. The basic graphics commands are as follows:

GRAPHICS ON 1/60: ESC 3 Horizontal movements of 1/60 inch. 1BH,33H/27,51
GRAPHICS ON 1/120: ESC G Horizontal movements of 1/120 inch. 1BH,47/27,71
GRAPHICS OFF: ESC 4 Ends both graphics modes; normal print. 1BH,04H/27,4 (5,9,D)

The printer observes the following rules in the graphics modes. All other commands, including set up and define commands, are unaltered.

1. SPACE and BACKSPACE move the carriage 1/60 or 1/120 inch horizontally, as selected by the GRAPHICS ON command.
2. LINE FEED and NEGATIVE LINE FEED commands move paper 1/48 inch vertically regardless of the horizontal mode.
3. CHARACTER PRINTING commands will not move the carriage after the character is printed. AUTO LF and AUTO CR/LF modes are ignored.

To program in GRAPHICS MODE, first select the horizontal step (1/60 or 1/120 inch). The four carriage movement commands can be used as "cursor control" to move the paper and carriage to the desired location: SPACE (right movement), BACKSPACE (left), LINE FEED (down), and NEGATIVE LINE FEED (up). After the correct position is reached, the printer is sent a character (typically a period to print a dot). The paper and carriage are not moved. Thus, you must program (1) paper and carriage movement, and (2) printing in the graphics mode.

Graphic mode is terminated by GRAPHICS OFF, CARRIAGE RETURN, or INITIALIZE PRINTER commands, or by turning the printer power off and on.

NO CARRIAGE MOVEMENT ON NEXT CHARACTER ONLY: ESC N 1BH,4EH/27,78

This command is used to inhibit carriage motion after printing a character. This command is useful for underscoring, slashing zeroes (Ø), forming composite symbols or foreign language characters, etc. When using proportional spacing, send the wider of the two characters first. The **ESC N** command must be sent before the character that is to have its automatic spacing inhibited. **ESC N** is obviously affected by the graphics commands. The carriage never moves after printing a character in Graphics mode; carriage motion must be separately programmed.

For example, the following Basic line will cause a zero to be printed with a slash through it: **LPRINT CHR$(27);"NO/";** The carriage will then move to the next position on the paper. (5,9)

PRINTER PROGRAM MODES

When the printer receives a character for printing, it has an internal look-up table which indicates the (1) Hammer Intensity, (2) Ribbon Advance, (3) Carriage Motion, and (4) Printwheel Position. For most users and most applications, this standard printing mode is used. There are some unique applications where it is necessary to program these four parameters. For example, if special character sequence printwheels are used, the printer must be told where characters are located on the printwheel.

There are three do-it-yourself modes available:

1. Program Mode - You specify the hammer intensity, ribbon advance, carriage distance and direction, and the ASCII code for each character to be printed. The chart in Appendix C may be used to identify correct values.

2. Secondary Program Mode - The same as Program Mode except that the carriage distance and direction are determined from the pitch setting and are not controllable.

3. Twintellect - Similar to Program Mode with two important differences. First, you specify hammer intensity, ribbon advance, character code, printwheel position, and character width (not carriage motion). Second, the values are loaded into the printer once (usually during printer set-up routines) and the printer stores the values in a lookup table. Before a character is printed, the printer looks up the parameters in the table in its memory. In the Program Mode you must send these parameters in a separate byte after each character. In the Twintellect mode the parameters are loaded into a table in the printer's memory.

PROGRAM MODE

SHIFT TO PROGRAM MODE: ESC SO 1BH,0EH/27,14
RETURN TO NORMAL MODE: ESC SI 1BH,0FH/27,15

This command places the printer in the Program mode and allows the host system to explicitly control the following functions for every character to be printed:

HAMMER INTENSITY. Intensities can be programmed from a minimum value of 1 to a maximum value of 7. A value of 0 defaults the intensity to the printer's normal internal value.

CARRIAGE MOTION. Distance can be from 0/120 inch to 15/120 inch.

PRINTWHEEL POSITION. As determined by the ASCII code.

This mode permits the use of special nonstandard sequence printwheels. The information necessary for: (1) locating a specific character spoke on the printwheel, (2) setting the proper hammer intensity, and (3) providing the proper character spacing, must be derived from data supplied with the special printwheel.

To implement this mode, the user must:

1. Enter the Program mode by sending the ESC SO command to the printer.

2. Send the ASCII code for the character to be printed.

3. Refer to the Appendix and derive the desired hammer intensity, and carriage spacing programming ASCII character.

4. Send the special programming ASCII character.

As an example of the use of Appendix C, assume that the character requires a hammer intensity of 4 and a spacing increment of 12/120". The special programming mode character will be an L. After entering the Program Mode (ESC SO), the computer sends the character followed by the printing information (L) for that character, then another character followed by its print information, and so on. (5,9,D and 5,9)

SECONDARY MODE

ENTER SECONDARY PROGRAM MODE: ESC # 1BH,23H/27,35
RETURN TO NORMAL MODE: ESC SI 1BH,0FH/27,15

This mode is similar to the Program Mode except that ribbon movement can be programmed independently, and carriage motion cannot be programmed. Carriage motion in this mode must be done using the PROGRAM MODE CARRIAGE command (US d). After entering the Program Mode an alternate method can be used to control printing parameters:

HAMMER INTENSITY. Relative hammer intensity can be selected from a minimum of 1 to a maximum of 7. If an intensity of zero is selected, the printer defaults to its normal hammer intensity value.

RIBBON ADVANCE. Relative increment value can be selected from a minimum of 2 to a maximum of 5.

CARRIAGE MOTION. Not programmable within this mode. Derived from the defined value for character spacing as determined by the setting of the PITCH switch, or by the DEFINE HORIZONTAL SPACING INCREMENTS commands.

PRINTWHEEL POSITION. As determined by the ASCII code.

To implement this mode the following example shows the use of a hammer intensity of 4 and a ribbon advance of 4:

Enter the Program mode by transmitting the ESC SO command.
Enter the Secondary Program mode by transmitting the ESC # command.
Send the ASCII code for the character to be printed.
Refer to Appendix C. A hammer intensity of 4 and a ribbon advance of 4 gives a special ASCII character of "K", "L", or "M".
Send one of the special programming characters ("K", "L", "M").

This command terminates the Right Margin Control mode. (5,9)

PROGRAM MODE CARRIAGE MOTION: US **d** for right movement 1FH/31

This command is only used when the printer is in one of the Program modes. This command causes the carriage to move either left or right between 1/120" and 63/120". **d** is the distance in 1/120 inch for RIGHT movement; for movement to the left, d is the distance to be moved plus 64 (decimal).

As an example, for a carriage move command of 12/120 inch to the RIGHT, the Basic command is

```
LPRINT CHR$(31);CHR$(12);
```

For a movement of 12/120 inch to the LEFT, the Basic command is

```
LPRINT CHR$(31);CHR$(76);
```

(5,9)

RETURN TO NORMAL MODE: ESC SI 1BH,0FH/27,15

This command terminates the SHIFT TO PROGRAM MODE, ENTER SECONDARY PROGRAM MODE, and USER TEST MODE. (5,9)

TWINTELLECT/DOWNLOAD COMMANDS

The download capability is a function unique to the Qume Connection and to the Qume SPRINT 11 PLUS series of printers.

All printwheels of one type (e.g., WP) have their alphanumeric characters arranged in the same sequence so that the printer knows where to find the character on the printwheel, how hard to fire the hammer, how far to move the ribbon, and in the case of WPS printwheels, how far to move the carriage. This information is in an internal table in the printer's Read Only Memory (ROM).

Some printwheels (e.g., non-English language characters) have a nonstandard sequence of characters and the printer must be programmed to know printwheel spoke position, ribbon advance, hammer force, and character width for these special printwheels. Examples of special sequence printwheels are Deutschland WP and Deutschland WPS. The capability for the Qume printer to use nonstandard sequence printwheels is called Twintellect, and this function may be selected by a printer DIP switch.

Because there are too many different sequences to practically store in the printer's memory, special commands allow the printer to accept and store (for as long as the printer power is turned on) a table of information for a special sequence printwheel. The table may be modified, enabled, or disabled by commands from the computer.

Normally, the printer is operated with Twintellect not selected (off). When Twintellect is selected on power-up, or if there is an error in downloading, the Deutschland WP or WPS table will be loaded by default, depending on the position of the DIP switch.

There are three TWINTELLECT/DOWNLOAD commands: (1) Enable the use of the Twintellect table, (2) Disable the use of the Twintellect table, and (3) Load or Modify the Twintellect table. These commands are discussed in greater detail in the paragraphs that follow.

ENABLE TWINTELLECT DOWNLOAD TABLE: ESC a e 1BH,61H,65H/27,97,101
DISABLE TWINTELLECT DOWNLOAD TABLE: ESC a d 1BH,61H,64H/27,97,100

These commands select or turn off the Twintellect function, overriding the printer switches. A table that has been downloaded can be accessed and used only after the **ESC a e** command has been received. If no table has been downloaded, this command will enable a default table (WPS if Twintellect is OFF, Deutschland WPS if Twintellect is ON). This default table from ROM is automatically placed into the download RAM table when the printer is powered up. Please note that while this will access all of the WPS printwheel information, it will not turn on the carriage proportional spacing algorithm; consequently, all printout will be in monospace. The printer's configuration switches must always be set to correspond to the pitch requirements of the installed printwheel.

The DISABLE command disables, but does not destroy, the download table.

DOWNLOAD OR MODIFY A TWINTELLECT TABLE: ESC a <data> 1BH,61H,3C...,3EH/
27,97,60...,62

This command allows a whole or partial table to be downloaded to the printer. For each printwheel character a field of five elements of information (ASCII character code, printwheel spoke position, ribbon advance, hammer intensity, and character width) is required. To download a table, a user would use the following sequence of information:

```
          1   2   3   4   5     1   2   3   4   5
ESC a <ASCII POS RIB HAM WID, ASCII POS RIB HAM WID,....:CHKSUM >
```

An ASCII comma is used to separate each field. The space shown between elements in a field is not required. The table of values in the printer corresponds to the five pieces of information for each character on the printwheel. The download format is best explained with an illustration.

Assume that for character code 42 hex the printwheel spoke location is 14 hex, the ribbon advance is 5, the hammer intensity is 4, and character width 7. (These values would be obtained from tables available from your local Qume Supplies Distributor.) The checksum calculated for all the values is OBF hex. You would then send the printer the DOWNLOAD command followed by ASCII **42145407,** (the ASCII comma is sent after each group of five; character width requires a leading zero be sent). In Basic, the command is:

LPRINT CHR$(27);"a<42145407,"; next sequence of five and **":BF>";**

where BF is the hex value of the checksum. Notice that the colon is sent instead of a comma after the final group of five values. When all the items in the table are entered an optional : **checksum** may be added to validate the data in the download operation. The checksum is calculated by taking the Exclusive Or of each ASCII character after the "<" up to and including the byte before the ":". Commas are included in the checksum calculation. Although legal values for character width cannot exceed OFH, two bytes are always required. The additional byte is reserved for future applications. Similarly, some ribbon advance and hammer intensity parameters are reserved for future use. Table 3 below shows the legal hex values which may be loaded into the Twintellect table.

Table 3. Size and Value Parameters for Twintellect Table

ELEMENT	BYTES REQUIRED	LEGAL VALUES (HEX)
ASCII Code	2	20 to 7F
Printwheel Spoke Position	2	00 to BE
Ribbon Advance	1	3 to 7
Hammer Intensity	1	1 to 6
Character Width	2	00 to 0F

Values for any printwheel character are easily modified without changing the entire table. Simply enter the modified values into a download command. Note that all five elements of the field must be included (eight bytes plus a comma). The ASCII character code will ensure that the new values are correctly located within the table.

Twintellect Download Error Conditions

If an error is identified during a download operation, the loading sequence is aborted at the location in the table where the error occurred. A default table (WPS if the Twintellect DIP switch is OFF, Deutschland WPS if Twintellect is ON) is then loaded to replace the current table. After the download sequence is aborted, the remainder of the table is printed out.

Download errors may be caused by any of the four following conditions:

1. A communication error occurred during the download operation.

2. A field does not contain exactly five elements (nine bytes including the comma separator).

3. One or more elements have a value outside the specified value range (the character is not 0-9 or A-F ASCII).

4. A checksum error occurred (when the checksum option is used).

PRINTER COMMANDS

COMMAND:	ASCII CHAR:	HEX / DECIMAL
BELL (AUDIBLE ALARM):	**BEL**	07H/7

Receipt of this command will cause the printer to sound its audible alarm. (5,9,D)

FORCE EXECUTION: ESC x, X 1BH,78H/27,120

These commands execute all accumulated motions completely before the next data can be processed. Motions accumulate in the buffer as a result of the printer's motion minimization feature. The printer's internal control program uses motion minimization to provide maximum speed. When horizontal or vertical motion commands (other than FORM FEED) are removed from the receive buffer, a sequence of them will be executed as a single motion. For example, seven SPACE commands (in 10 pitch) would result in a single carriage motion of 0.7 inches; a SPACE command followed by a BACKSPACE command would result in NO horizontal motion; six LINE FEED commands would result in a single paper motion of one inch.

One use of the FORCE EXECUTION command is to execute all of the instructions and print all of the characters which have been received by the printer before a sheet feed command. Send a FORCE EXECUTION command before sending the sheet feed commands.

INITIALIZE PRINTER (RESTORE): ESC SUB I or 1BH,1AH,49H/27,26,73 or
ESC CR P 1BH,0DH,50H/27,13,80

Both of these commands initialize (reset) the printer. ESC SUB I, however, does not clear out the buffer. ESC CR P does clear out the buffer. The Twintellect table, if downloaded, will not be changed by either of these commands. Both commands cause the printer to read all of the DIP switches and the following parameters are set:

- The carriage is moved to column 0.
- The printwheel is synchronized with the printer's electronics.
- The right margin is set at the right most column (right side frame).
- The left margin is set at column 0.
- All tab stops are cleared.
- The top margin is set at the top of form position.
- The bottom margin is set at the position defined by the form length switch.
- Both Graphics modes OFF.
- Forward Print mode ON.
- Both Program modes OFF.
- Right Margin Control mode OFF
- Underscore, Bold Overprint, Shadow Print, and No Print modes OFF.
- User Test mode OFF. (5,9,D)

SHEET FEEDER COMMANDS

These commands control the Qume's cut sheet feeder, which is an accessory. These commands are unique to Qume. If Qume's sheet feeder is installed on the printer, a FORM FEED command will eject the paper currently in the printer, load a new sheet of paper, and move that sheet of paper to the desired print position. If the FORM FEED command is used in this fashion, the following commands (ESC i, ESC j, ESC e) will not need to be used

SHEET INSERT FROM TRAY ONE: ESC i 1BH,69H/27,105

This command instructs the printer to insert a sheet of paper from tray one of the Cut Sheet Feeder. As a platen driven, mechanical device, the Cut Sheet Feeder is only operational when the printer receives the appropriate commands from the computer. If the Cut Sheet Feeder is not installed, an **ESC i** command will result in a Form Feed.

SHEET EJECT: ESC e 1BH,65H/27,101

This command instructs the printer to eject a sheet of paper to the collection bin of the Cut Sheet Feeder.

TEST COMMANDS

COMMAND:	ASCII CHAR:	HEX / DECIMAL
TERMINAL SELF TEST:	**ESC SUB SO**	1BH,1AH,0EH/27,26,14

The Terminal Self Test routine is a comprehensive test of the printer's mechanical and electronic functions. Once the Self Test routine is initiated, all further commands will be ignored until the test is completed. (5,9)

USER TEST MODE COMMANDS

ENTER USER TEST MODE: **ESC @ T** 1BH,40H,54H/27,64,84

The User Test mode allows the host computer to program the printer to perform a test program of any length up to a maximum of 500 characters.

To utilize the user test mode:

1. The computer sends ESC @ T. (5,9)
2. Up to 500 characters are entered into the printer buffer.
3. Cancel the last character sent by sending a **NUL**. (5,9)
4. The computer sends an **EOT** when the program is entered. (5,9)
5. To run the test one time, send **STX** (PERFORM USER TEST ONCE). (5,9,D)
6. To run a continuous test, send **SOH** (PERFORM USER TEST CONTINUOUSLY). (5,9,D)
7. To halt the continuous test, send **ENQ** (HALT CONTINUOUS USER TEST). (5,9)
8. To leave the User Test Mode and erase it, send **ESC SI** (RETURN TO NORMAL MODE).

STATUS REQUEST - ESC SUB ENQ 1BH,1AH,05H/27,64,5
STATUS REPLY - ESC: (status) 1BH,3AH/27,58

The STATUS REQUEST command causes the printer to transmit a status reply. For example, upon receipt of the ESC SUB ENQ command, the printer might respond with an ESC: A. ASCII A represents binary 1000001 (refer to Appendix A). The bit definition of "A", as indicated in Table 4, is as follows:

b1 = 1 Successful execution of Self-Test routine or successful execution of User Down Load Command (status is shown for whichever command was last executed)
b2 = 0 Standard character sequence selected
b3 = 0 No operator attention required
b4 = 0 Printer not in CHECK
b5 = 0 Auto Line Feed mode not selected
b6 = 0 Printer idle
b7 = 1 (Bit 7 will always be a "1")

Table 4. Status Word Bit Definition

			b7→	1	1	1	1	1	1	1	1
			b6→	0	0	0	0	1	1	1	1
			b5→	0	0	1	1	0	0	1	1
			b4→	0	1	0	1	0	1	0	1
b3 ↓	b2 ↓	b1 ↓									
0	0	0		@	H	P	X	`	h	p	x
0	0	1		A	I	Q	Y	a	i	q	y
0	1	0		B	J	R	Z	b	j	r	z
0	1	1		C	K	S	[	c	k	s	{
1	0	0		D	L	T	\	d	l	t	|
1	0	1		E	M	U	]	e	m	u	}
1	1	0		F	N	V	^	f	n	v	~
1	1	1		G	O	W	_	g	o	w	DEL

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The STATUS REQUEST command bypasses the receive buffer, and the printer's STATUS REPLY response is immediate. Note also that a STATUS REPLY is always transmitted at the conclusion of any successful Self-Test routine execution initiated from the host.

SPECIAL CHARACTER PRINTING

COMMAND:	ASCII:	HEX / DECIMAL
PRINT CHARACTER AT PRINTWHEEL POSITION 004:	ESC SP	1BH,20H/27,32
PRINT CHARACTER AT PRINTWHEEL POSITION 002:	ESC /	1BH,2FH/27,47

There are two positions on all printwheels which do not correspond to a single standard ASCII character code. The reason for this is that of the 96 ASCII codes from 20 hex to 7F hex, two are special: SPACE and DELETE. SPACE is really a motion command and DELETE may have special functions, including resetting the printer. These special characters, though not necessarily the same for all printwheels, usually are:

- or = located at position 002
¢ or | located at position 004

APPENDIX A
ASCII CODE CHART

Bits b_4	b_3	b_2	b_1	Row \ Column →	0 b_7 0 b_6 0 b_5	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
					0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
1	0	1	1	B	VT	ESC	+	;	K	[	k	{
1	1	0	0	C	FF	FS	,	<	L	\	l	|
1	1	0	1	D	CR	GS	-	=	M	]	m	}
1	1	1	0	E	SO	RS	.	>	N	^	n	~
1	1	1	1	F	SI	US	/	?	O	-	o	DEL

HEXIDECIMAL = ASCII COLUMN + ROW

APPENDIX B
SAMPLE BASIC FORMATTING PROGRAM

```
LIST
 10 REM SAMPLE PROGRAM TO SET MARGINS
 20 REM
 30 REM  TOP, LEFT, RIGHT, TEXT LENGTH
 40 REM
 50 TM=6: REM  TOP MARGIN, LINES DOWN FROM TOP OF FORM
 60 TL=54: REM  NUMBER OF TEXT LINES ON PAGE
 70 LM=10: REM  LEFT MARGIN, NUMBER OF SPACES
 80 RM=72: REM  RIGHT MARGIN, NUMBER OF CHARACTERS PER LINE
 90 REM  RIGHT MARGIN = CHARACTERS/LINE + LEFT MARGIN SPACES
100 REM
110 REM
120 REM  SET LEFT AND TOP MARGINS:
130 REM
140 FOR I=1 TO TM
150 LPRINT
160 NEXT I
170 REM
180 FOR I=1 TO LM
190 LPRINT " ";
200 NEXT I
210 LPRINT CHR$(27); "+";: REM  SET TOP MARGIN
220 LPRINT CHR$(27); "9";: REM  SET LEFT MARGIN
230 FOR I=1 TO RM
240 LPRINT " ";
250 NEXT I
260 LPRINT CHR$(27);"O": REM  SET RIGHT MARGIN
270 REM
280 FOR I=1 TO TL: REM  TEXT LENGTH, NUMBER OF LINES
290 LPRINT
300 NEXT I
310 LPRINT CHR$(27);"-": REM  SET BOTTOM MARGIN
OK
```

APPENDIX C

PROGRAM MODE "SPECIAL CHARACTER"

CARRIAGE	HAMMER 0	1	2	3	4	5	6	7	RIBBON INCREMENT VALUE
0	NUL	DLE	SP	0	@	P	`	p	2
1	SOH	DC1	!	1	A	Q	a	q	
2	STX	DC2	"	2	B	R	b	r	
3	ETX	DC3	#	3	C	S	c	s	
4	EOT	DC4	$	4	D	T	d	t	
5	ENQ	NAK	%	5	E	U	e	u	
6	ACK	SYN	&	6	F	V	f	v	
7	BEL	ETB	'	7	G	W	g	w	3
8	BS	CAN	(	8	H	X	h	x	
9	HT	EM	)	9	I	Y	i	y	
10	LF	SUB	*	:	J	Z	j	z	
11	VT	ESC	+	;	K	[	k	{	4
12	FF	FS	,	<	L	\	l	|	
13	CR	GS	-	=	M	]	m	}	
14	SO	RS	.	>	N	^	n	~	5
15	SI	US	/	?	O	-	o	DEL	

Carriage motion is in increments of 1/120".
Zero hammer intensity causes default to normal intensities.
Ribbon feed is a carriage motion function of the Program Mode and is not independently selectable except during the Secondary Program Mode.
Shaded areas show illegal commands.

APPENDIX D
DECIMAL - HEX - ASCII CONVERSION CHART

CONTROL CODES			NUMBERS, SYMBOLS			UPPER CASE			LOWER CASE		
DEC	HEX	ASCII	DEC	HEX	ASCII	DEC	HEX	ASCII	DEC	HEX	ASCII
0	0	NUL	32	20	SP	64	40	@	96	60	`
1	1	SOH	33	21	!	65	41	A	97	61	a
2	2	STX	34	22	"	66	42	B	98	62	b
3	3	ETX	35	23	#	67	43	C	99	63	c
4	4	EOT	36	24	$	68	44	D	100	64	d
5	5	ENQ	37	25	%	69	45	E	101	65	e
6	6	ACK	38	26	&	70	46	F	102	66	f
7	7	BEL	39	27	'	71	47	G	103	67	g
8	8	BS	40	28	(	72	48	H	104	68	h
9	9	HT	41	29	)	73	49	I	105	69	i
10	A	LF	42	2A	*	74	4A	J	106	6A	j
11	B	VT	43	2B	+	75	4B	K	107	6B	k
12	C	FF	44	2C	,	76	4C	L	108	6C	l
13	D	CR	45	2D	-	77	4D	M	109	6D	m
14	E	SO	46	2E	.	78	4E	N	110	6E	n
15	F	SI	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	48	30	0	80	50	P	112	70	p
17	11	DC1	49	31	1	81	51	Q	113	71	q
18	12	DC2	50	32	2	82	52	R	114	72	r
19	13	DC3	51	33	3	83	53	S	115	73	s
20	14	DC4	52	34	4	84	54	T	116	74	t
21	15	NAK	53	35	5	85	55	U	117	75	u
22	16	SYN	54	36	6	86	56	V	118	76	v
23	17	ETB	55	37	7	87	57	W	119	77	w
24	18	CAN	56	38	8	88	58	X	120	78	x
25	19	EM	57	39	9	89	59	Y	121	79	y
26	1A	SUB	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	59	3B	;	91	5B	[	123	7B	§
28	1C	FS	60	3C	<	92	5C	®	124	7C	¶
29	1D	GS	61	3D	=	93	5D	]	125	7D	†
30	1E	RS	62	3E	>	94	5E	©	126	7E	™
31	1F	US	63	3F	?	95	5F		127	7F	DEL

APPENDIX E
COMMAND SET SUMMARY

	ASCII	HEX	DECIMAL
MARGIN COMMANDS			
Set Top Margin:	ESC +	1B,2B	27,43
Set Bottom Margin:	ESC -	1B,2D	27,45
Set Left Margin:	ESC 9	1B,39	27,57
Set Right Margin:	ESC 0	1B,30	27,48
Right Margin Control On:	ESC O	1B,4F	27,79
Right Margin Control Off:	ESC Y	1B,59	27,89
LINESPACING (VERTICAL) COMMANDS			
Define Vertical Spacing Increments:	ESC L d1 d2	1B,4C	27,76
Alt. Define Vert. Spacing Increments: (distance + 1)	ESC RS	1B,1E	27,30
Set Form Length:	ESC F d1 d2	1B,46	27,70
Auto Carriage Return/Line Feed On:	ESC W	1B,57	27,87
Auto Carriage Return/Line Feed Off:	ESC Z	1B,5A	27,90
Auto Line Feed On:	ESC comma	1B,2C	27,44
Auto Line Feed Off:	ESC period	1B,2E	27,46
CHARACTER SPACING (HORIZONTAL) COMMANDS			
Define Horizontal Space Increments:	ESC E d1 d2	1B,45	27,69
Define Horizontal Space Increments Alt.:	ESC US(dis+1)	1B,1F	27,31
WPS On:	ESC $	1B,24	27,36
WPS Off:	ESC %	1B,25	27,37
TAB COMMANDS			
Set Horizontal Tab Stop:	ESC 1	1B,31	27,49
Clear Horizontal Tab Stop:	ESC 8	1B,38	27,56
Clear All Horizontal Tab Stops:	ESC 2	1B,32	27,50
Set Tab List:	ESC (list	1B,28	27,40
Clear Tab List:	ESC) list	1B,29	27,41
PAPER MOVEMENT (VERT. MOTION) COMMANDS			
Line Feed:	LF	0A	10
Negative Line Feed:	ESC LF	1B,0A	27,10
Half Line Feed:	ESC U	1B,55	27,85
Negative Half Line Feed:	ESC D	1B,44	27,68
Auto Carriage Return/Line Feed On:	ESC W	1B,57	27,87
Auto Carriage Return/Line Feed Off:	ESC Z	1B,5A	27,90
Absolute Vertical Tab to a Line Number:	ESC P d1 d2	1B,50	27,80
Absolute Vertical Tab to a Line Number ALT.:	ESC VT (dis+1)	1B,0B	27,11
Relative Vertical (Paper Feed) Motion:	ESC V n1 n2 n3	1B,56	27,86
Form Feed:	FF	0C	12
CARRIAGE MOVEMENT (HOR. MOTION) COMMANDS			
Horizontal Tab:	HT	09	9
Absolute Horiz. Tab to a Column Number:	ESC C d1 d2	1B,43	27,67
Absolute Horiz. Tab to a Column Number Alternate):	ESC HT (dis+1)	1B,09	27,9
Relative Horizontal Motion:	ESC H n1 n2 n3	1B,48	27,72
Backward Print:	ESC 6	1B,36	27,54
Forward Print:	ESC 5	1B,35	27,53
Auto Bidirectional Printing On:	ESC <	1B,3C	27,60

	ASCII	HEX	DECIMAL
Auto Bidirectional Printing Off:	ESC >	1B,3E	27,62
Space:	SP	20	32
Backspace:	BS	08	8
Backspace 1/120":	ESC BS	1B,08	27,8
Carriage Return:	CR	0D	13
PRINTING COMMANDS			
Underscore On:	ESC I	1B,49	27,73
Underscore Off:	ESC J	1B,4A	27,74
Bold Overprint On:	ESC K d	1B,4B	27,75
Bold Overprint Off:	ESC M d	1B,4D	27,77
Shadow Print On:	ESC Q	1B,51	27,81
Shadow Print Off:	ESC R	1B,52	27,82
No Print On:	ESC S	1B,53	27,83
No Print Off:	ESC T	1B,54	27,84
GRAPHICS COMMANDS			
Graphics On 1/60":	ESC 3	1B,33	27,51
Graphics On 1/120":	ESC G	1B,47	27,71
Graphics Off (all):	ESC 4	1B,04	27,4
No Carriage Movement on Next Character:	ESC N	1B,4E	27,78
PRINTER PROGRAM MODES			
Shift to Program Mode:	ESC SO	1B,0E	27,14
Enter Secondary Mode:	ESC #	1B,23	27,35
Program Mode Carriage Motion:	US d	1F	31
Return to Normal Mode:	ESC SI	1B,0F	27,15
Enable Twintellect Download Table:	ESC a e	1B,61,65	27,97,101
Disable Twintellect Download Table:	ESC a d	1B,61,64	27,97,100
Download or Modify Twintellect Table:	ESC a (data)	1B,61,3C	27,97,60...62
PRINTER COMMANDS			
Bell:	BEL	07	7
Force Execution:	ESC x or ESC X	1B,78	27,120
Initialize Printer (Restore):	ESC SUB I or	1B,1A,49	27,63,73
	ESC CR P	1B,0D,50	27,13,80
SHEET FEEDER COMMANDS			
Sheet Insert From Tray One:	ESC i	1B,69	27,105
Sheet Eject:	ESC e	1B,65	27,101
TEST COMMANDS			
Terminal Self-Test:	ESC SUB SO	1B,1A,0E	27,26,14
Enter User Test Mode:	ESC @ T	1B,40,54	27,64,84
Perform User Test Once:	STX	02/2	
Perform User Test Continuously:	SOH	01/1	
Halt Continuous User Test:	ENQ	05/5	
Return to Normal Mode:	ESC	1B/27	
Status Request:	ESC SUB ENQ	1B,1A,05	27,64,5
Status Reply:	ESC : (status)	1B,3A	27,58
SPECIAL CHARACTER PRINTING			
Print Position 004:	ESC SP	1B,20	27,32
Print Position 002:	ESC /	1B,2F	27,47

APPENDIX F
INTERFACING WITH POPULAR COMPUTER SYSTEMS

SPRINT 11 PLUS/QUME CONNECTION RS-232-C TO IBM PERSONAL COMPUTER OPERATION

You need:

-- A QUME CONNECTION RS-232-C Model I Interface
-- A serial interface card for the IBM Personal Computer (the IBM Asynchronous Communication Adapter card), and
-- A "modem eliminator" cable with two female connectors (see Step 2)

1. IBM PERSONAL COMPUTER SERIAL INTERFACE INSTALLATION

Follow the instructions in the IBM manual for installation of the Asynchronous Communication Card. Install the jumper on the asynchronous communication board for RS-232-C operation. The IBM card has a programmable Universal Asynchronous Receiver Transmitter (UART), which you will program in Step 4 below.

If you have a (non-IBM) card which has DIP switches, configure it to: 9600 baud, no parity, wordlength 8, one stopbit. The cable description in step 2 may not apply, however, since the card may not have the same pin connections. (Qume has not tested non-IBM cards.)

2. CABLE CONNECTION - QUME CONNECTION RS-232-C TO IBM PC

Both the IBM PC and Qume printer are configured as "terminals". You will need to do <u>one</u> (but not both) of the following:

Buy a "modem eliminator" cable with two female connectors. The modem eliminator reverses pins 2 - 3, and 6 - 20 (other pins are reversed but have no effect on the IBM/QUME CONNECTION operation). If you cannot find a modem eliminator with two female connectors (both the IBM and the QUME CONNECTION have male connectors), use a standard modem eliminator in conjunction with a sex changer cable.

Make up a cable with two DB-25P female connectors:

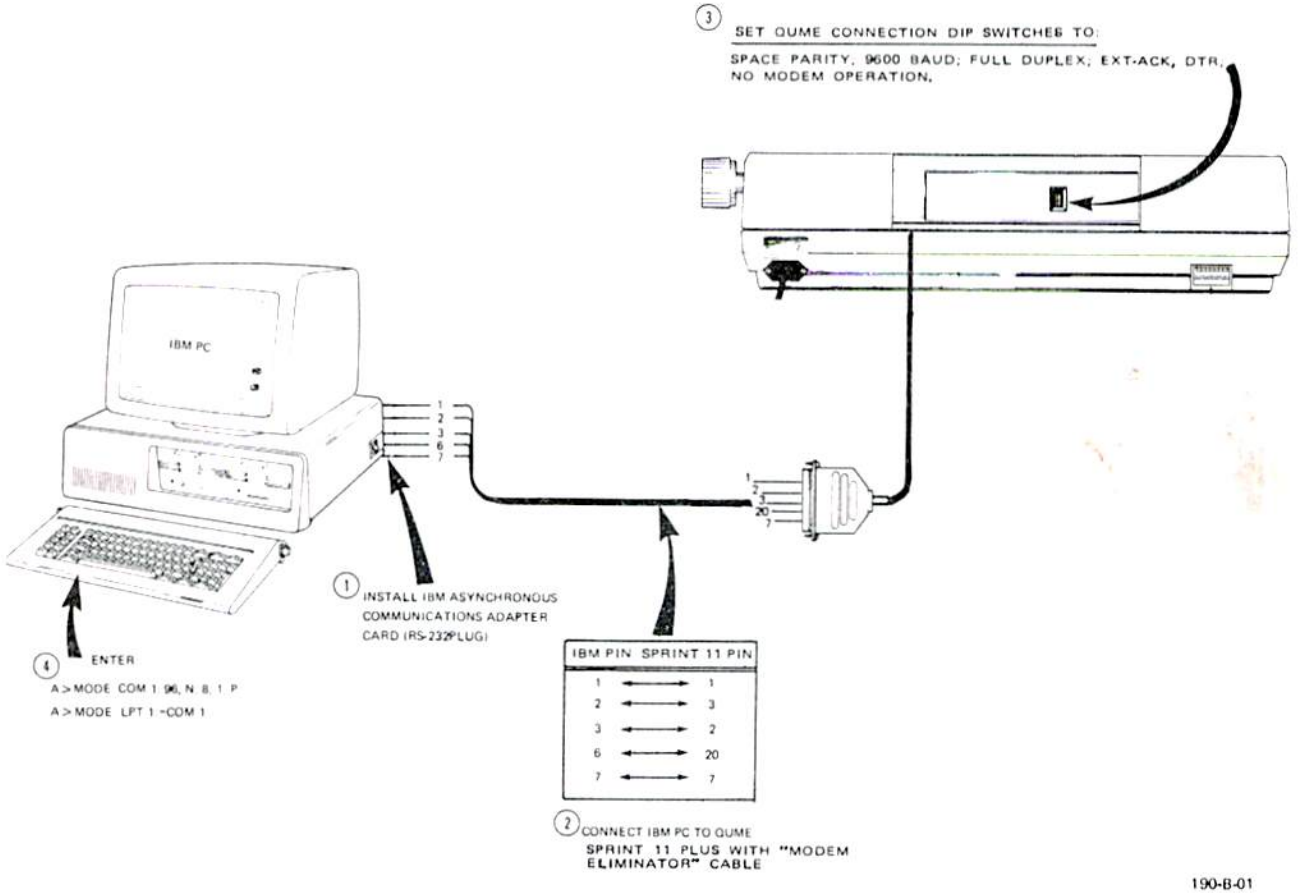
IBM Pin 2 to Qume Pin 3 (data into the printer)
IBM Pin 3 to Qume Pin 2 (data from the printer)
IBM Pin 6 to Qume Pin 20 (printer DTR handshake signal to IBM PC)
IBM Pin 1 to Qume Pin 1; IBM Pin 7 to Qume Pin 7 (These are grounds)

3. DIP SWITCH SETTINGS

Configure the QUME CONNECTION/SPRINT 11 PLUS DIP switches as follows:

Parity: Space	No Modem operation
Full Duplex	Baud Rate: 9600 (see Software Notes)
Handshaking: ETX-ACK,DTR	Auto CR/LF: OFF
Auto LF: OFF	Stop print on paper out: your choice
PITCH: must match printwheel	Auto bidirectional printing: your choice

Twintellect: OFF unless special printwheels are used


3 SET QUME CONNECTION DIP SWITCHES TO:
SPACE PARITY, 9600 BAUD; FULL DUPLEX; EXT-ACK, DTR;
NO MODEM OPERATION.
IBM PC
1
2
3
6
7
1 INSTALL IBM ASYNCHRONOUS COMMUNICATIONS ADAPTER CARD (RS-232PLUG)
4 ENTER
A>MODE COM 1 96, N, 8, 1, P
A>MODE LPT 1 =COM 1
IBM PIN SPRINT 11 PIN
1 ↔ 1
2 ↔ 3
3 ↔ 2
6 ↔ 20
7 ↔ 7
2 CONNECT IBM PC TO QUME SPRINT 11 PLUS WITH "MODEM ELIMINATOR" CABLE

190-B-01

4. PROGRAMMING THE IBM PC FOR THE SPRINT 11 PLUS/QUME CONNECTION RS-232-C

The default printer port for the IBM PC is the parallel port (LPT1:). The serial communications card must be set up to match the Qume printer; then the IBM PC printer port must be reassigned to the serial communications card.

First, use the **MODE** command (details in the IBM DOS manual) to set the serial card parameters:

```
A>MODE COM1:96,N,8,1,P
```

Next, assign the printer port to the communications card:

```
A>MODE LPT1:=COM1
```

To send output to the Qume printer, follow the general instructions in the IBM Manuals for printing.

Typing **Cntrl & PrtSc** will send whatever is entered on the monitor screen to the Qume printer as well as the screen. Type **Cntrl & PrtSc** again and the printer output will stop.

Type **Shiftkey & PrtSc** and the entire monitor screen will be printed.

In Basic, **LLIST** and **LPRINT** send output to the printer instead of the monitor screen.

Printing is discussed in the IBM Manuals Guide to Operations (Keyboard 3-6 and 3-10) and Basic (2-9, 4-130, and 4-140).

The IBM PC will need to be set up each time the DOS is booted unless you use a special file (called AUTOEXEC.BAT) which is automatically run by the computer every time the DOS is booted. Refer to the "Batch" command description in the IBM DOS Manual for details about setting up and using this file. A sample AUTOEXEC.BAT file (which works) looks like this:

```
REM:  Autoexec file assigning printer to serial port
REM:  9600 baud, no parity, 8 bits, 1 stopbit, serial printer protocol
MODE COM1:96,N,8,1,P
MODE LPT1:=COM1
DATE
TIME
```

5. SOFTWARE NOTES

The Sprint 11 PLUS can be used with most software which runs on the IBM Personal Computer. You may find two limitations:

The first is the incompatibility between the command sets of dot matrix printers and letter quality printers (such as the Qume Sprint 11 PLUS).

The Qume Sprint 11 PLUS will print the letters, numbers, and symbols the same as a dot matrix printer (e.g., an "A" is an "A" on both types of printers). However, dot matrix printers use special codes and control sequences to do things like print large characters and do various modes of graphics. Thus, software which uses the dot matrix printer "graphics" mode cannot be used without modification with a Qume Sprint 11 PLUS (or any other letter quality printer, for that matter). The Qume printer is able to do graphics, but your software must be changed to use the Qume command set, (described in the QUME CONNECTION RS-232-C Interface Manual.) If you have software written for dot matrix printers and it uses graphics, you will probably need the source code in order to change the graphics commands. If you do not have the source code, you probably will not be able to use the graphics mode.

The second problem concerns early distribution versions of IBM's Easywriter word processing software. A printer driver was included in the IBM software which did not use "handshaking"* to determine when the printer receive buffer is full. Without handshaking, data will overflow the printer's receive buffer, because a 9600 baud data rate is much faster than the printer's 40, 55, or 70 character per second printing speed. The solution to this problem is to send data to the printer at a rate which will not overflow the printer receive buffer. At 300 baud the printer can print data as fast as it is received--handshaking is not required.

Therefore, if you have an early version of Easywriter, you may need to set the data rate to 300 baud (the change is underlined) instead of 9600 baud:

--The IBM PC command is: **MODE COM1:30,N,8,1,P**

--Set the QUME CONNECTION DIP switches to 300 baud instead of 9600 baud.

Without handshaking, you cannot use printer pause, since the buffer may fill up and overflow during the time the pause is on. You may also have to print one page at a time, since changing paper may require the printer to be placed into pause. Using the bold, shadow, or underline functions of the printer causes the printer throughput to slow down because the printer has to do extra work (e.g., printing a character once then going back and underlining the same character). These functions may have to be minimized if handshaking is not used.

Consult your IBM dealer if you have an early version of Easywriter.

---

* Qume's recommended method of "handshaking" is to have the IBM PC read printer pin 20, DTR. The Serial Communications Interface Section in the QUME CONNECTION RS-232-C Model I Interface Manual describes this handshaking in more detail.

TRS-80 MODEL II (WITH TRS-DOS) TO QUME CONNECTION RS-232-C INTERFACE

You need:

-- A cable, as described in step 2 below
-- TRSDOS operating system for the TRS-80 Model II

1. TRS-80 SERIAL PORT

The TRS-80 Model II has two RS-232-C serial interface ports. These will be programmed using programs in the TRSDOS operating system. There is nothing to adjust or set-up inside the computer. You do not need a "terminator plug" for the A connector.

2. CABLE CONNECTION - TRS-80 TO QUME CONNECTION

You will need a "modem eliminator" cable. This is a cable with two DB-25-P connectors which reverses pins 2 and 3 (the transmit and receive lines).

Connect the Qume Connection to Serial Port **B** using the modem eliminator cable. The connector is labelled on the TRS-80 Model II.

3. QUME PRINTER SET-UP

Set the Qume Connection module for the following protocol. The asterisks (*) are settings <u>different</u> from the standard factory setting for the module.

9600 Baud
* Space parity (parity not used - always SPACE)
Full Duplex
* XON/XOFF handshake
No Modem operation
Bi-Directional printing On
Twintellect Off (for most normal printing)
Auto CR/LF Off
Stop on Paper Out Off
6 lines per vertical inch spacing (for most normal printing)
* Auto Line Feed On (turn this Off if the printer double spaces)
Form Feed 11 inches (for a standard size business letter)
12 pitch character spacing (for a standard 12 pitch printwheel)

4. PROGRAMMING THE TRS-80 FOR THE QUME CONNECTION

These procedures are for TRSDOS on the TRS-80 Model II. They do not apply to CP/M.

The TRSDOS assumes the TRS-80 will use a printer connected to the parallel port. You must use a program to reconfigure the TRS-80 to use Serial Port B as the printer port.

Reboot the TRS-80 (use the switch on the front or enter RESET).

Enter the command

SETCOM B=(9600,8,N,1)

This sets Port B to 9600 baud, 8 bits per word, no parity, and one stop bit. Once you use the SETCOM command you may not change the parameters without rebooting the system. If you enter **SETCOM** and no parameters, the computer will tell you how the serial ports are configured.

Next, enter the command

FORMS S

This tells the software programs that the printer output should go to serial port B (which you just configured). You may change the parameters of FORMS at any time.

Follow the TRSDOS instructions for printing to send output to the Qume printer.

SPRINT 11 PLUS TO HEATH/ZENITH COMPUTER OPERATION

This description covers interfacing the Qume Sprint 11 Plus printer with RS-232-C Qume Connection module installed to a Heath H-89 or Zenith Z-89 computer configured with the Heath/Zenith version of CP/M* (2.2.03). Qume has not tested the interface with HDOS or with the newest Heath/Zenith computers such as the Z-90.

You need:

-- A Sprint 11 Plus with Qume Connection RS-232-C interface module,

-- A Heath H-89 (or Zenith Z-89) computer with CP/M version 2.2.03 or later. The computer must have at least one serial port, besides the CRT port, configured as DCE (Data Communication Equipment).

1. CABLE CONNECTION - HEATH/ZENITH COMPUTER TO QUME CONNECTION

The cable supplied with the RS-232-C Qume Connection has the proper connector to mate with the Heath/Zenith computer serial port. Plug the RS-232-C connector into the port nearest the computer power switch. The port is labelled "340-347", which is a computer port I/O address.

2. QUME CONNECTION MODULE SET-UP

Set the switches on the Qume Connection module to:

Space Parity, No Modem, DTR handshake, 9600 baud, half duplex.
Stop on Paper out switch may be set to your preference.
DIP switches on the printer may be set to your preference.

3. SETTING UP THE HEATH/ZENITH COMPUTER

The Heath/Zenith computer needs to be configured for the Qume printer. There are three parameters which will be changed using a Heath software program called CONFIGUR

-- The Heath serial port will be set to 9600 baud (4800 is default).

-- The Printer Ready Status Signal will be changed on the Heath computer from pin 4, RTS, to pin 20, DTR.

-- The Printer Ready Status Polarity will be changed from Low to High.

---

*CP/M is a registered trademark of Digital Research, Inc.

Implement these changes by running the Heath-supplied program **CONFIGUR.** This program is designed to examine your specific computer hardware configuration (memory size, number of serial ports, various disk information, etc.) and allow you to change certain parameters. You may make the changes only to memory (meaning that they will be lost when you do another cold boot of CP/M), or they can be made permanent if you are using a disk that is NOT write-protected. You may choose to update a disk with the new parameters so that whenever you boot the computer, the serial port will be set up for the Qume Sprint 11 Plus printer.

First, run **CONFIGUR.** When the program asks for "Standard System (Y or N)?" enter N.

Next, select option A from the menu ("Set Terminal and Printer Characteristics").

Now enter C to select the line printer baud rate for change. Enter 9 to change the baud rate to 9600 and press the return key (the port address will stay the same at 340 Q). The same menu will reappear but the baud rate for the line printer should now say "9600". Enter M to change the Printer Ready Signal Polarity to High. Enter N to change the Printer Ready Signal to DTR.

Exit by pressing **Y** to return to the main menu, and then X or Y to return to CP/M. **X** makes the changes only to memory, Y makes the changes to both memory and the disk (if it is not write protected). Entering Z will make no changes and leave the default parameters as is.

Remember that unless you write the changes to disk, you will have to run CONFIGUR each time you cold boot CP/M and want to use the printer.

SPRINT 11 PLUS/QUME CONNECTION RS-232-C TO APPLE II PERSONAL COMPUTER

You need:

-- A QUME CONNECTION RS-232-C Model I interface module
-- An Apple Super Serial Card (SSC)

1. APPLE SUPER SERIAL CARD INSTALLATION

Follow the instructions in the Apple Super Serial Card Installation and Operating Manual for installation of the card. The jumper block on the SSC should point to "TERMINAL", thus functioning as a Modem Eliminator. Configure the two sets of DIP switches in the SSC as follows:

SWITCH 1 - Switches 1, 5, and 6 DOWN (OFF)
Switches 2, 3, 4, and 7 UP (ON)

SWITCH 2 - Switches 2, 3, 6, and 7 DOWN (OFF)
Switches 1, 4, and 5 UP (ON)

These switch settings configure the card for 1200 baud, P8A Emulation Mode, 1 stop bit, no delay after CR, 80 character line, and Auto LF. P8A Emulation Mode is chosen rather that Printer Mode as it offers ETX/ACK handshaking capability.

Although the above configuration works quite well, it only utilizes one fifth of the SPRINT 11 PLUS receive buffer. Printer speed can be increased rather significantly by configuring the SSC as follows:

SWITCH 1 - Switches 1, 2, 3, and 5 DOWN (OFF)
Switches 4, 6, and 7 UP (ON)

SWITCH 2 - Switches 2, 3, 4, 6, and 7 DOWN (ON)
Switches 1 and 5 UP (ON)

These settings configure the card for 9600 baud, printer mode, 1 stop bit, and DTR handshaking.

2. CABLE CONNECTION - QUME CONNECTION RS-232-C TO SSC

The cable supplied with the QUME CONNECTION RS-232-C has the proper connector to mate with DB-25P connector on the SSC.

3. QUME PRINTER SET-UP

Configure the DIP switches on the QUME CONNECTION RS-232-C and on the Sprint 11 PLUS as follows:

Baud Rate: 1200 or 9600 (depending upon how you configure the SSC)
Parity: Mark
Full Duplex
No Modem
Handshaking: ETX-ACK, DTR
Auto CR/LF OFF
Auto LF OFF
Stop Print On Paper Out: your choice
Twintellect: OFF unless special printwheels used
Auto Bidirectional Printing: your choice
6 Lines Per Vertical Inch Spacing (for most normal printing)
Form Feed 11 inches (for a standard business letter)
12 pitch character spacing (for a standard 12 pitch printwheel)

4. PRINTING

To send characters from the Apple II to the Sprint 11 PLUS under Basic or DOS, boot the Apple II and type in PR#s to send output to the printer (make sure the SSC is in slot s).

SPRINT 11 PLUS/QUME CONNECTION RS-232-C TO OSBORNE PERSONAL COMPUTER

1. CABLE CONNECTION - QUME CONNECTION RS-232-C TO OSBORNE PERSONAL COMPUTER

The cable supplied with the QUME CONNECTION RS-232-C has the proper connection to mate with the female DB-25P connector on the Osborne's serial port.

2. QUME PRINTER SET-UP

Configure the DIP switches on the QUME CONNECTION RS-232-C and on the Sprint 11 PLUS as follows:

Baud Rate: 1200
Parity: Space
Full Duplex
No Modem
Handshaking: ETX-ACK, DTR
Auto CR/LF OFF
Auto LF OFF
Stop Print On Paper Out: your choice
Twintellect: OFF unless special printwheels used
Auto Bidirectional Printing: your choice
6 Lines Per Vertical Inch Spacing (for most normal printing)
Form Feed: 11 inches (for a standard business letter)
12 pitch character spacing (for a standard 12 pitch printwheel)

3. PROGRAMMING THE OSBORNE FOR THE SPRINT 11 PLUS/QUME CONNECTION RS-232-C

To properly configure the Osborne to communicate with the Sprint 11 PLUS/QUME CONNECTION RS-232-C, you must first insert the system diskette and call SETUP. Initially, the SETUP program will display a menu with options A through F. Select the printer option by pressing A. The display will then change and give you a choice of five communication protocols. Select option B - Qume's ETX/ACK protocol.

Return to the original menu and determine the current baud rate (300 baud and 1200 baud are the only choices). If 300 baud is currently selected, change the rate to 1200 by pressing B. Pressing the letter changes the selection from its current setting to the other setting. Although the Sprint 11 PLUS does communicate at 300 baud, the full advantages of the printer's motion minimization features are only realized at a higher rate of speed.

4. PRINTING

With the Sprint 11 PLUS and QUME CONNECTION DIP switches properly set and the Osborne properly configured, you should have no problems sending characters from the computer to the printer. Under CP/M, Control P can be used to turn the printer ON or OFF. Also, PIP LST:=[filename.ext] will print the designated file. Under MBASIC, LLIST and LPRINT will send data to the printer. Under Wordstar, the "P" option or the "M" option can be used to print files or files and data respectively. See your Osborne manual for further details.

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THE QUME CONNECTION RS-232-C Model 1 Interface
Reorder Number 32075, November 1983.

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